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TITLE: The Impact of Electronic Knowledge-Based Nursing Content and Decision-Support on Nursing-Sensitive Patient Outcomes

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13. SUPPLEMENTARY NOTES

14. ABSTRACT Background: Advances in health information technology (HIT) and the use of evidence-based practices (EBP) and clinical decision support (CDS) tools in electronic health records (EHR) hold great promise. Hospitals use varied strategies to increase the uptake of EBP including policy-, education-, and technology-based interventions but these strategies are relatively untested. Theory-based research is needed to gain a deeper understanding of all the factors that influence the uptake of EBP by nurses in acute care.
Objective: This study was designed to evaluate the impact of an evidence- and policy-based technology innovation, featuring actionable EB recommendations embedded into policy and the content and CDS tools in the EHR to support nurses to know and use best practices related to six nurse-sensitive phenomena: pain, medication adherence, depression/suicide, fall risk, pressure ulcer risk/actual, and delirium to improve patient outcomes. The study was guided by the Dissemination and Implementation of Evidence-based Policy Framework (adapted from Dodson, Brownson, & Weiss, 2012) to evaluate the impact of the innovation under usual deployment conditions and to see if implementation strategies could improve effectiveness.
Hypothesis 1: The innovation, deployed with passive dissemination, will have a positive effect on nurse knowledge and use of EBP, and the achievement of nurse-sensitive patient outcomes at baseline.
Hypothesis 2: Implementation strategies (audit/feedback of baseline results, education with behavioral expectations, leader-driven unit implementation and maintenance) will improve nurse knowledge and use of EBP and produce measurable improvements in outcomes compared to passive dissemination alone.
Methods: This pre/post parallel convergent mixed methods study was conducted with consenting medical/surgical and critical care nursing units (N = 27 units) from 3 diverse facilities [a quaternary medical center (A) and two community hospitals (B), one unionized (C)] where the innovation was in place for over two years. Theory-based measures were developed to evaluate staff nurse and leader knowledge and use EBP policies for the selected phenomena. Baseline data were collected from multiple sources including non-participant observations, chart audit, a nurse survey, guided patient interviews, and established nurse sensitive process and outcome metrics to identify knowledge/use gaps and create a multimodal implementation intervention to address deficits and improve outcomes with reassessment 6 months later.
Results: Baseline evaluations [Q2, 2014 (A) and Q3 2015 (B&C)] revealed a supportive culture, functioning technology, with gaps in knowledge (N=536, M=56.3% correct, SD 8.4) and use of EBP under dissemination-based deployment. A multimodal implementation intervention was delivered to staff (N=921-89%) and leaders (N=53-100%) with monitoring and support over 6 months. Despite high training participation and adoption, units had limited capacity to implement and maintain best practice with rare use of electronic reports. Some improvement in knowledge (N=523, M=61.8% correct, SD 8.8 $p<0.001$) and use of EBP occurred with little change in outcomes.
Conclusion: A theory-based mixed methods approach provided researchers with a rich pool of data for evaluating how policy-, education- and technology-based strategies supports the uptake and use of EBP by nurses in acute care. These findings suggest that the technology, deployed using dissemination-based strategies, was helpful but not sufficient to support nurses to clinically know and use of best practices over time. NOTE: A Federal Military Advisory Committee actively conferenced with the Research Team quarterly during the first 2 years of the study. The Advisory Team confirmed that the context and outcomes of interest in the study are consistent with the inpatient care situation in military hospitals.

15. SUBJECT TERMS				
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Table of Contents

	Page
1. Introduction……	6
2. Keywords……	6
3. Accomplishments…….....	7
a. Statement of Work (SOW) Goal Achievement……..	7
• Essential component identification and measure development (Goal #1)…..	7
• Validation of essential KBN elements/function in EHR (Goal #2)…….	7
• Measure pretesting (Goal #3)……...	8
• Baseline data collection (Goal #4)……	8-9
• Intervention study design (Goal #5)…….	10
• Intervention delivery with varied maintenance (Goal #6)……	11
• Unit implementation tracking (Goal #7)…….…….	11
• Post-intervention evaluation (Goal #8)…….	12
• No-Cost Extension – Replication Goals (#4 – 8)…….....	13-15
b. Opportunities for Training and Professional Development…….…..	16
c. Dissemination (refer to Products below)……	16
d. Future Plans……	17
4. Impact……..……	17
a. Impact on Nursing / Nursing Informatics…….……..	17-19
b. Impact on Other Disciplines……...……	19-20
c. Impact on Technology Transfer…….	20
d. Impact on Society Beyond Science and Technology…...……..	20
5. Changes……..……..	20
a. Changes in Approach/Delays…….	20
b. Changes in Expenditures……	21
c. Human Subjects Protocol Changes……	22-23
6. Products…….……..	24
a. Publications, conference papers, and presentations……	24-26
b. Technologies or techniques ……...……	26
c. Inventions, Patents and/or Licenses……	26
d. Other Products……	26
7. Participants including Federal Military Advisory Council……	27-34
8. Special Reporting Requirements (Quad Chart) ……...	35

Table of Contents

Page

9. Appendices……. 36

A. Knowledge-Based Nursing – Definition and Conceptual Framework……..…… 36
B. KBN Innovation – Core Components…… 37-38
C. Dissemination & Implementation of Evidence-Based Practice Framework……. 39-40
D. Baseline Unit Descriptions…....……... 41
E. Methodology and Baseline Findings…….. 42-47
F. Study Intervention with Varied Maintenance Strategies (Group A & B)…….. 48-49
G. Post Intervention Findings…….. 50-56
H. Limitations/Conclusions...…….. 57
I. References…….. 58-63

1. INTRODUCTION:

This report provides a summary of our research achievements over the past 3+ years conducting a novel study investigating how nurses and nurse leaders practice in the real world. This theory-based pre/post mixed methods study evaluated the impact of an evidence- and policy-based technology innovation featuring customized content and clinical decision-support (CDS) tools in the electronic health record (EHR) designed to support nurses to know and use evidence-based practices (EBP) to achieve nurse-sensitive outcomes. The study was conducted with consenting inpatient nursing units (N = 27 units) from 3 diverse acute care facilities (one urban quaternary Magnet recognized medical center and two rural community hospitals) where the EBP policies and technology were in place for more than two years. An implementation science *theory-based approach was used to identify the factors that influence the uptake of EBP by nurses in acute care and deepen our understanding of the processes to support interpretation. Theory-based measures were developed to evaluate staff nurse and leader knowledge and use of EBP policies for 6 nurse-sensitive phenomena: pain, falls, pressure ulcers, medication adherence, delirium, and depression/suicide. Baseline data were collected from multiple sources including non-participant observations, chart audit, a nurse survey, guided patient interviews, and established nurse sensitive process and outcome metrics to identify knowledge/use gaps. Baseline evaluation revealed a supportive culture, functioning technology, with gaps in knowledge and use of EBP practices under dissemination-based deployment conditions. A feedback-based multimodal implementation intervention was delivered with unit-based implementation support over 6 months. Despite high training participation and commitment, unit leaders had limited ability to implement and maintain best practices after training. Some improvement in knowledge and use of EBP behaviors occurred with little change in outcomes. These findings suggest that EBP can be disseminated using policy, training, and technology, but dissemination without implementation and maintenance strategies may not be sufficient to ensure the uptake and use of best practices with sufficient fidelity to achieve and maintain improved outcomes over time.

*Note: The theory-based multimodal intervention approach resulted from collaborating with international experts in the field of dissemination and implementation (D & I) science.

2. KEYWORDS: Provide a brief list of keywords (limit to 20 words).

- Behavior Observation Techniques
- Clinical Nursing Research
- Decision Support Systems, Clinical
- Dissemination, Information
- Evidence-Based Nursing
- Evidence-based Practice
- Health Services Research
- Knowledge Management
- Models/theoretical/organizational
- Nursing Evaluation Research
- Nursing Care
- Nursing Informatics
- Nursing Process
- Organizational Context
- Outcome and Process Assessment (HealthCare)
- Patient Outcomes
- Patient Care Planning
- Performance metrics
- Research methodology

3. ACCOMPLISHMENTS:

a. Statement of Work Goal Achievement

GOAL #1: Identify essential knowledge and nursing practice behaviors (components)
STATUS: Milestone Complete 29-JUN-2013

- The KBN Research Team reviewed and systematically analyzed the evidence-based practice synthesis documents to identify essential knowledge & practice behaviors for six phenomena: Acute Pain, Medication Non-adherence, Depressive Symptoms/Suicide, Risk for Falls/Fall-related Injury/Post Fall Management, Pressure Ulcer Risk/Actual, and Delirium Risk/Actual-all Venues (ICU and Med-Surgical)
- The KBN Research Team conducted iterative process meetings to identify the "essential" components - defined as those knowledge or behavior components that are necessary, indispensable, and foundational for staff and/or nurse leaders to carry out the patient care or meet the expected outcome/goal. A spreadsheet was created to analyze:
  - Recommendations from the synthesis regarding the assessments, diagnoses, interventions, and outcomes for each phenomena including population-specific requirements based on age or risk factors
  - Details about which components are embedded into a policy or standard
  - Details about how component is entered into the EHR/functionality (e.g. content, clinical decision support tool, etc,)
  - Details about the location where component is documented (e.g. flow sheet/Patient Education/Care Plan/Medication Administration Record, etc.)
  - Details about how the researcher knows the component was completed and if a CDS tool was used correctly
- PI participated in the 2013 Midwest Nursing Research Society (MNRS) Preconference Workshop (Chicago) on Dissemination and Implementation Science to identify potential theory-based frameworks appropriate for this study. PI had the opportunity to network with Dr. Ross Brownson about his efforts to gather D&I models into a catalog to support researchers to review and select models to support research.

GOAL #2: Validate that essential KBN electronic content/tools are incorporated in the electronic health record (EHR) and functioning as designed
STATUS: Milestone Complete 12–DEC-2013

- Utilized findings from Goal #1 as the basis for the gap identification conducted simultaneously during syntheses review of essential knowledge and nursing practice behaviors (preliminary list of gaps identified).
- Submitted specifications (17-Jun-2013) for building the "sidebar report" a print group report that provides nurses with viewable information about patient risk factors for use in matching interventions and patient education. Completed and tested. AUG-2013
- Submitted specifications for building manual mechanism to support staff to initiate screening even if the tools were not triggered on admission – DEC 2013
- Submitted specifications for daily and monthly electronic report for capturing depressive symptom screening, delirium symptoms and use of antipsychotic medication, and

medication adherence screening on the Key Performance Indicator daily and Monthly reports. NOV-DEC 2013.

GOAL #3: Develop reliable and valid measures and measurement processes for evaluating the implementation and adoption of KBN-based practices
STATUS: Milestone Complete DEC-2013; Additional metrics added FEB-2015

Measures, data collection codebooks, and procedures were developed and pilot tested:

- ***Nonparticipant Observation*** tools and procedures were developed on paper to support observers to capture the use of EBP during admission and ongoing patient care with subsequent database entry. The observers worked together to develop and pilot test the paper documents on a non-study unit to ensure reliable observations and recording.
- The ***Audit Tool*** was created in conjunction with observation data to evaluate documentation associated with each observation. It was identified that observation data needed to be entered prior to initiating the chart audits for optimal efficiency. The auditors worked together to create the data entry form in SurveyMonkey to ensure reliable data extraction.
- ***Nurse Survey***: a 4 part tool was developed to collect nurse/nurse leader demographics, perceptions about research utilization, knowledge of policy-based EBP for the 6 phenomena and associated workflow (41 questions) and perceptions about unit-based content using a reliable and valid tool (Alberta Context Tool-used author permission). The survey was built into SurveyMonkey™. The survey link was inserted into facility-based software for delivery to the nurses. This software is the customary way staff access education (familiar) and was used to securely track participation and support nurses to gain access to the Nurse Information Letter (informed consent), instructions for the survey, the survey link, and closes by providing a certificate to document participation.
- ***Patient Survey***: key concepts that were known to influence the uptake of evidence-based messages by patients were identified including patient characteristics and decision-making preference, teaching methods, and outcomes of teaching including knowledge and use of recommended behaviors. A guided-interview tool was developed with a tool for conducting a preliminary medical record review to screen for subject eligibility and to evaluate of patient education information by nurses. These data collection tools were built in SurveyMonkey and loaded on tablets for data collection.
- ***Process and Outcome Metrics***: Process and outcome metrics were identified in the study protocol and extracted from existing sources.
- ***Preceptor Metrics***: Tool were created to gather demographics, preceptor knowledge and use of monitoring tools specific to their assigned maintenance strategy (A – usual care vs. B – KPI Daily and other electronic reports), and track time and activities for the study.

GOAL #4: Conduct baseline measurement to identify gaps (knowledge, practice behaviors, or EHR build) to improve integrity of the planned KBN intervention study
STATUS: Milestone Complete JUL-2014

- AHC Biomedical Institutional Review Board (IRB) Study #13-142E approved the study with expedited review a with waiver of documentation of informed consent for nurse subjects, HIPAA authorization for retrospective medical record review, and requirement for maintaining a copy of the patient subject consent in the subject's medical record.
- DOD/USAMRMC Award #W81XWH-13-1-0034 protocol was submitted for review to the US Department of Defense Human Research Protection Office (HRPO) JAN- 2014

- Brigit Ciccarello, M.A., Regulatory Compliance Specialist, Telemedicine & Advanced Technology Research Center (TATRC) Research Program Officer reviewed protocol and advised to proceed with the administrative steps for unit recruitment with initiation of data collection after HRPO approval.
- Recruitment meetings were kicked off with study site Nurse Leaders on 7-Jan-2013. A recruitment video was created to support a consistent message to all eligible units/nurses. Unit-level recruitment meetings were held with the use of a recruitment video. Unit recruitment was completed 28-FEB-2014 with all units (N=23) agreeing to participate.
- Primary Site baseline assessments were carried out on 11-MAR through 30-JUN-2014:
  - Nonparticipant Observations (N=379 RN/Patient observations, 54 Nurse Leaders observations, and 40 RN/Patient admission observations) were conducted per protocol on all the study units (6 hour sessions) Med/Surgical Units = 4 observations/unit (approximately 25 patients/unit), Critical Care Units = 9 observations each (approximately 20 patients/unit). Admissions (n=2/unit) were observed (3 units did not complete admission observations because patient admission processes were completed by another unit). Observations were gathered using (2) paper-based tools and transcribed/entered into an electronic database tool using SurveyMonkey™ software. Data entry for observations associated with the nurse leaders were completed 15-AUG-2014 and for nurse observations by SEPT-2014. Data were downloaded into excel, cleaned and uploaded into the analytic software.
  - Audits (N=379 + 40 Admissions) were conducted retrospectively using the established process. Audits took much longer than to complete (approximately 45 minutes/observation) than initial estimate. Data entry for all baseline audits was completed JAN-2015; Data were downloaded into excel, cleaned and uploaded into the analytic software.
  - Patient Survey (N=581 patients were screened; n=184 patients were recruited and interviewed per protocol on the 18 non-ICU units during the study period. Chart audits and interview data were entered into SurveyMonkey. Data were downloaded into excel, cleaned, and uploaded into the analytic software.
  - The Nurse Survey Tool was opened for data collection after unit observation were completed to minimize staff awareness what the observers were focusing on during nonparticipant observations. The Nurse Survey was "kicked" off with the Nurse Leaders with fliers and email message sent to staff nurses employed on the study units and hospital float pool. The link to the confidential Nurse Survey was delivered to eligible participants using the Learning Connection. Participation was monitored with weekly reports to nurse leaders to support recruitment.
  - Process and Outcome Metrics: Unit-based nurse sensitive outcome data were gathered from various sources including the EHR-based electronic reports (e.g. KPI Monthly report to describe adherence with policy-based standards for documentation), hospital census (e.g. Patients/Patient Days, Length of Stay), and the National Database for Nursing Sensitive Indicators reports (e.g. Total/RN Hours per Patient Day, Falls/Injuries, Pressure Ulcers) and patient satisfaction (Hospital Consumer Assessment of Healthcare Providers and Systems/HCAPS) reports reported to external monitoring company used by the study institution. Data were entered into excel, cleaned and uploaded into the analytic software.

- All units received a summary report of measures pertinent to the study as part of the audit/feedback component of the intervention to support nurse leaders to identify priorities for implementation on the unit.

GOAL #5 Design the Intervention Study strategy including the delivery method
STATUS: Milestone Complete 30-AUG-2014

- The PI applied and was selected for participation in the Training Institute for Dissemination and Implementation (D&I) Research in Health (TIDIRH) – JUL-2014 in Boston. This traineeship provided the opportunity to network with national/international experts on a D&I project to adapt our theory-based approach and plan a multimodal implementation intervention (audit/feedback, training with behavioral objectives, and unit implementation), and adjust the plan from doing treatment and control to conducting a head-to-head comparison of the strategies used to maintain the best practices. The D&I experts suggested using an active implementation strategy for both groups to take advantage of resources to support patient care (rather than using funds to deliver an intervention that would have no impact).
- The schedule and logistics for Optimization Training sessions was established to register and train 942 eligible staff nurses using electronic registration tracking system (Learning Connection). Dates and rooms were set up 3 months in advance to allow nurse leaders to preplan classes and unit staffing and ensure room availability. Completed 30-JUNE-2014
- Findings from the Patient and Nurse Surveys and observer reports were analyzed and used to identify gaps in EBP knowledge and use at baseline. Completed 15-AUG-2014
- Units were randomized into two groups (A & B) based on difference in strategy used to monitor implementation (usual care vs. electronic monitoring using reports).
- Format, learning objectives, methods, behavioral expectations, training materials and evaluation for Nurse Leader (N=2) and Staff Nurse (N=42) Optimization Training Course sessions were finalized. Four "break-out" sessions were created to address knowledge gaps including: 1) Navigator/Flowsheets/Care Planning, 2) Mental Status (Delirium Risk/Actual)/Depressive Symptoms, 3) Pain/Comfort/Function, and 4) Patient Education/Medication Nonadherence
- Two (2) training videos were developed to deliver study overview and audit/feedback results at baseline) and (6) brief videos to demonstrate key training content (e.g. mental status assessment (4), ADL assessment (1), and depression screening) 31-AUG-2014
- Training materials were created including:
  - Hand-outs: The 8-page handout included an overview describing the KBN core components and a list of the "essential practices" for implementation on the unit and worksheets for each session to practice the documentation during the case studies.
  - Reference Materials: 25 folders containing 15 printed reference sheets of content available in the EHR for participants to reference throughout the sessions.
  - Humorous incentive ("BINGO") game with template filled with key KBN words to enhance participant interaction. Winners received "I Won at KBN BINGO" button and were encouraged to wear on to promote the training & encourage adoption.
- Completed the continuing education credit application including speaker biography and conflict of interest review and support/budget letter from USAMC sponsor. The course was awarded 3.67 contact hours from the Wisconsin Nurses Association.
- Developed a "Trainer Schedule" for KBN team and worked through Outlook to block schedules and to staff all of the training sessions.

- Worked with the Aurora Conference Center staff and online meeting space reservation systems at two locations in arrange audio visual requirements and room set up for all 44 training sessions at two sites.
- Collaborated with the Learning Connection staff to generate weekly lists of nurses enrolled in the training sessions and communicate unit-based registration data to monitor progress to the Nurse Leaders.

GOAL #6 Carry-out the intervention study at the ASLMC site
STATUS: Milestone Complete 02-DEC-2014

- Optimization Training was delivered for all Nurse Leaders (44-100%). 4-SEPT-2014
- Optimization Training for staff nurses started on 9-SEPT-2014. The initial plan was to utilize breakout sessions to promote small group discussion for enhanced learning. The first session revealed that small group discussion led to variations in content delivery with challenges to time management. We altered the training plan immediately, reducing the number of instructors to 2-3 per session and promoting small group table discussions with the larger session rather than breaking out. Logistical adjustments were made to the "Trainer Schedule" and meeting room reservations to accommodate the change.
- Collaborated with the Learning Connection staff to update the tracking system with confirmed attendance for documentation and dissemination of contact hour certificates.
- Weekly attendance report was sent to Nurse Leaders so confirm attendance. The PM and the Post-Award Grant specialist worked closely with the nurse leaders to ensure accurate and timely reimbursement for staff nurse training participants.
- Optimization Training was delivered for 90% (N=849) staff nurses 31-OCT-2014 with supplemental training sessions for unit preceptors by study group (A & B) to review the essential practices, their role, and how to use assigned monitoring strategy.
- Optimization Training Session evaluations were summarized. Findings were entered into the database for analysis.
- Course evaluations were summarized & submitted for WNA continuing education credit
- Baseline findings indicated that knowledge deficits existed for staff nurses and nurse leaders. Nurse leaders were observed to have limited clinical time to implement and monitor behavior change (p. 14). To strengthen the intervention, unused grant funding designated for training or clinical site support were approved and repurposed to fund: 1) CNS/NC time to oversee implementation efforts and 2) Staff nurse preceptors (2 per unit) indirect time to monitor and support unit implementation (OCT-2014)
- After the Optimization Training was completed, meetings were held with the nurse leaders to identify which EBP behaviors were high priorities for implementation and maintenance on their unit and to identify a plan for using funded preceptor support using non-direct patient care time.

GOAL #7 Complete tracking process of the intervention
STATUS: Milestone Completed 20-JULY-2015

- Funds were provided to support unit leaders to engage their preceptor staff (2/unit) to implement the essential practices by identifying priorities and working to improve adopter skills by monitoring and providing feedback to maintain the practices on the unit.
- Preceptors used the Tracking Tool to document time and activities conducted to support unit implementation 30-NOV-2014

- The study site "Magnet" Program Manager worked with units on quality improvement activities, to ensure that the implementation activities aligned with established priorities and to support unit-based nurse leaders and preceptors to document their follow-up.
- Formal meetings and informal support was provided to unit leaders and preceptors to support them to implement and maintain essential practices. Support concluded with the start of the post-implementation assessment 30-MARCH-2015
- Preceptor Tracking Logs, documenting time and activities used to support unit implementation, were collected. The data were reconciled with paid time and entered into the database for analysis. 15-SEPT-2015

GOAL #8 Complete a full evaluation measuring the impacts of KBN methods on patient outcomes

STATUS: Milestone Complete with Dissemination in Progress

- Research Team reviewed the data collection forms and procedures to prepare for reassessment. Minor adjustments were made and approved by IRB (IRB Modification #9)
- The post-implementation assessment data collection master schedule for 23 units at the study site was drafted to accommodate student rotation. The plan was communicated to all sites with team calendars schedules blocked. The plan had to be adjusted schedule to accommodate an unplanned CMS regulatory visit at the study site.
- Data collection and unit orientation materials were produced. The Clinical Advisors distributed met with units to distribute unit materials and prepare for post-intervention assessment for the study 15-MARCH-2015
- The data collection team members met to review the plan, procedures, and the updated forms. A new Patient Survey data collector (Badger) was oriented 17-MARCH-2015
- The Learning Connection module, the Nurse Survey and unit-based recruitment materials for the Nurse Survey were updated and approved by the IRB (IRB Modification #10) 14-MAY-2015
- The Study Clinical and Management Advisors to plan unit-level recruitment for the post-intervention Nurse Survey. The group committed to using the same process for supporting staff nurse participation on work time with contributions to the unit Education Fund (45 minutes of average staff nurse salary for time spent). Active recruitment support was provided including weekly participation updates to Unit leaders
- Primary Site Post-Intervention assessments were carried out: MAR through 20-JUL-201
  - Nonparticipant Observations (N=362 RN/Patient observations, 60 Nurse Leaders observations, and 48 RN/Patient admission observations) were conducted per protocol on all the study units (6 hour sessions) 5-JUN-2015
  - Audits (N=362 + 48 Admissions) were conducted retrospectively using the established process.
  - Patient Survey (N=505 patients were screened; n=180 patients were recruited and interviewed per protocol on 18 non-ICU units during the study period. 5-JUN-2015
  - Nurse Survey (N=467) 20-JULY-2015
- The Learning Connection access was closed and downloaded participant rosters. Participation lists were cross checked with unit demographics to confirm participation and ensure grant reimbursement to units.
- Participation count was finalized with funds transferred to reimburse units for staff nurse and leader time spent taking the survey ($10,791).

- Post-implementation Nonparticipant, Admission and Nurse Leader Observation, and Chart Auditing was initiated with auditor orientation & reliability testing 25-SEPT-2015
- Post implementation Nurse Survey data was downloaded from SurveyMonkey, cleaned, and uploaded into data analysis software. NOV-2015
- Post-implementation Patient Survey data was downloaded from SurveyMonkey, cleaned, and uploaded into data analysis software. DEC-2015
- Unit priority, Implementation (preceptor), and Unit Process/Outcome data were gathered from multiple sources, entered into excel, cleaned, and uploaded into data analysis software JAN-2016
- Post-implementation Nonparticipant, Admission and Nurse Leader Observation data was downloaded from SurveyMonkey, cleaned, and uploaded into data analysis software. FEB-2016
- Detailed data analysis plan was created with iterative meetings with biostatistician

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No Cost Extension – Replicate Study at (2) community hospitals to increase generalizability

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NOTE: Research Team contact COR (10-FEB-2015) to confirm the presence of residual funds and ask for direction to request to repurpose funds to replicate study. Formal request with revised SOW submitted 8-JUN-2015 and approved 22-JUL-2015.

Replication Study Goals #1-3 - Not Applicable for replication

Replication Study Goal #4: Conducting baseline measurements to identify gaps
STATUS: Milestone Complete 14-OCT-2015

- Proposal for study submitted to Chief Nurse for Aurora Lakeland Medical Center (ALMC) and Aurora Memorial Hospital Burlington (AMHB); Study interest/support was confirmed. 15-MAY-2015
- Proposal with revised Statement of Work (SOW) submitted to the Department of Defense Contracting Officer Representative (COR) with request to repurpose unused grant funds toward a no-cost 9-month extension to replicate the study at two smaller sites to increase generalizability. Approval received 8-JUNE-2015
- Study protocol was revised for the replication and submitted as a modification with the Aurora IRB with supporting documentation. Obtained IRB approval 28-MAY-2015
- Met with Chief Nurse and Unit Leaders to plan unit-level recruitment and resources needed for the study including leaders to serve as advisors. 25-JUNE-2015
- Updated KBN Study recruitment video for new sites (with IRB approval) JUNE-2015
- Recruitment meeting help with 4 inpatient nursing units into the Study who all agreed to participate. 30-JULY-2015
- A master schedule for baseline assessment at the new study sites was prepared with accommodation for student rotation. The data collection plan was communicated to units and data collectors.
- Unit orientation packets were prepared. Clinical advisors at the new study sites were oriented to their role as a support for unit assessments.
- Data collection materials were prepared including data collection forms and posters

- Space and resources including printer, phone and storage was secured for the new sites.
- Nurse Survey was updated in SurveyMonkey and Learning Connection for new sites.
- Secondary Site Baseline Assessments were carried out – SEPT 2015
  - Nonparticipant Observations (N=51 RN/Patient observations, XX Nurse Leaders observations, and 10 RN/Patient admission observations) 25-SEPT-2015
  - Audits (N=51+10 Admissions) were conducted retrospectively using established process.
  - Patient Survey (N=74 patients were screened; n=27 patients were recruited and interviewed per protocol on 2 non-ICU units during the study period. 23-SEPT-2015
  - Nurse Survey (N=51 – 90%) was open for 3 weeks ending 14-OCT-2015
- Collaborated with leaders to ensure accurate reimbursement for Nurse Survey hours

Replication Goal #5: Design the Intervention Study strategy including the delivery method

- Data from the Patient and Nurse Surveys were downloaded into excel, cleaned and uploaded into the analytic software. These findings and observer reports were analyzed and compared to the findings from the primary site. Gaps were found to be similar to findings at the primary site with lower leader knowledge scores and less oversight.
- Findings were used to update the audit/feedback training video content and associated training materials for optimization training.

Replication Goal #6: Carry out the intervention at the new study sites
STATUS: Milestone Complete 20-NOV-2015

- Optimization Training 2-NOV-2015 to 20-NOV-2015
- Research team collaborated with site Nurse Leaders to plan and schedule staff for Optimization Training sessions using the Learning Connection with sessions at both sites.
- Updated continuing education application was submitted and approved.
- Registration was monitored with weekly updates to Leaders to optimize participation.
- Optimization Training was delivered for nurse leaders (1 – session, N=9 – 100%) and staff (13 sessions, N=72 – 79%) 20-NOV-2015
- Supplemental training sessions were held for unit preceptors to review the essential practices, their role, and how to use assigned monitoring strategy. 10-DEC-2015
- Optimization Training Session evaluations were summarized with findings entered into the database for analysis.
- Participation lists were cross checked with unit demographics to confirm participation and ensure grant reimbursement to units.
- Course evaluations were summarized & submitted for WNA continuing education credit

Replication Goal #7: Complete Tracking Progress at new sites
STATUS: Milestone Complete 25-APRIL-2016

- Conducted webinar with Nurse Leaders to review best practices and site-based results and to train regarding the use of electronic reports to implement and maintain essential evidence-based practices 13-NOV-2016
- Met with unit leaders to identify unit priorities for implementation and discuss how to utilize grant funds for additional training and support by unit preceptors 9-DEC-2015

- Scheduled, planned and conducted two CNS/Preceptor "super' training session to discuss roles and strategies to monitor unit implementation and ensure follow up and maintenance 10-DEC-2015
- Communicated weekly with CNSs, Leaders and Preceptor throughout January and February to provide targeted coaching and support both in person and via conference call as needed to ensure implementation strategies are being deployed.

Replication Goal #8: Complete Full Evaluation
STATUS: Milestone Complete

- Completed baseline nonparticipant and admission observation data entry and chart audits
- Initiated unit and site-specific nursing sensitive process and outcome data collection
- The post-implementation assessment data collection master schedule for the 4 units was drafted to accommodate student rotations. The plan was communicated to the units and the team calendar schedules were blocked.
- Data collection and unit orientation materials were produced. The Clinical Advisors distributed met with units to distribute unit materials and prepare for post-intervention assessment for the study APR-MAY-2016
- The Learning Connection module, the Nurse Survey and unit-based recruitment materials for the Nurse Survey were updated and approved by the IRB. The Study Clinical and Management Advisors to plan unit-level recruitment for post-intervention Nurse Survey.
- Replication Sites Post-Intervention assessments were carried out: 22-APR- MAY2016
  - Nonparticipant Observations (N=53 RN/Patient observations, XX Nurse Leaders observations, and 8 RN/Patient admission observations were conducted per protocol on all the study units (6 hour sessions)
  - Audits (N=53 + 8 Admissions) were conducted retrospectively using protocol
  - Patient Survey (N=64 patients were screened; n=33 patients were recruited and interviewed per protocol on 2 non-ICU units during the study period.
  - Nurse Survey (N=56) - Ending JUN 2016
- The Learning Connection access was closed and downloaded participant rosters. Participation lists were cross checked with unit demographics to confirm participation and ensure grant reimbursement to units.
- Participation count was finalized with funds transferred to reimburse units for staff nurse and leader time spent taking the survey.
- Post-implementation nonparticipant, admission and nurse leader observation, and chart auditing was initiated
- Post implementation Nurse Survey data was downloaded from SurveyMonkey, cleaned, and uploaded into data analysis software.
- Post-implementation Patient Survey data was downloaded from SurveyMonkey, cleaned, and uploaded into data analysis software.
- Unit priority, Implementation (preceptor), and Unit Process/Outcome data were gathered from multiple sources, entered into excel, cleaned, and uploaded into analysis software
- Post-implementation Nonparticipant, Admission and Nurse Leader Observation data was downloaded from SurveyMonkey, cleaned, and uploaded into data analysis software.
- Detailed data analysis plan was created with iterative meetings with biostatistician

3. ACCOMPLISHMENTS

b. Opportunities for Training and Professional Development – Principal Investigator

- **Midwest Nursing Research Society (MNRS) Annual Preconference Workshop on Dissemination and Implementation (D&I) Science (April 2013, Chicago).** The Study PI attended a half-day workshop on D&I Science featuring experts, Drs. Ross Brownson and Bernadette Melynk who reviewed the key concepts and evidence-based models used to support the uptake of EBP. This conference provided an opportunity to increase knowledge of D&I frameworks and to network with experts re: how to identify criteria and select a theory-based model to guide the study.
- **National Institutes of Health (NIH) Training Institute for Dissemination and Implementation Research in Health** (TIDIRH; July 20-25, 2014, Boston). The Study PI submitted an application to refine the KBN Impact Study research protocol as the project of focus for an intensive 5 day training seminar for designing and conducting dissemination and intervention (D & I) research. Dr. Hook was one of 41 participants selected from a pool of 289 international applicants who met the credentialing criteria and proposed a feasible D & I project to work on. The KBN Impact Study protocol and intervention plan was reviewed by national and international experts who confirmed the appropriateness of the conceptual framework adaptation and the Intervention Plan with audit/feedback, training, unit implementation) and varied maintenance. PI participation in the conference was funded by NIH. TATRC funds were utilized to cover travel expenses.

Opportunities for Training and Professional Development – Nurse Leaders and Staff

- Contact hour approved study-related training to optimize the knowledge and use of best practices was delivered for nurse leaders (N=53) at all three sites including Training Session (4 hours/leader) with Implementation follow up training for leaders and preceptors (N=52) for 2 hours)
- Contact hour approved study-related training to optimize the knowledge and use of best practices was delivered for staff nurses (N=921) at all three sites (3.5 hours/nurse paid for by the grant.

c. Dissemination

- **Internal Audiences**
  Nursing Newsletter Articles: 4
  Leader Presentations: 4
  Staff Nurse Presentations: ASLMC Nursing Grand Rounds (1 hr) – 19-MAY-2016 and Magnet Moving Forward Conference (30 min) – 22-NOV-2016
  Aurora Research Institute (ARI) Interdisciplinary Presentations (1 hr) – 6-DEC-2015 and 21-JUN-2016

- **External Audiences – Refer to Products re: Conference/Manuscript development**

d. Future Plans

- Additional analyses are in progress using convergent mixed methods approaches with this extensive dataset
- Several manuscripts are in progress that must be finished.
- Abstract was accepted for a podium presentation on the Patient Education aspect of the findings for the Midwest Nursing Research Society (MNRS) Conference in Minneapolis MN in April 2017.
- The KBN Research is currently contributing to research aimed at evaluating nursing content. Dr. Bonnie Westra, PhD, RN, FAAN (University of Minnesota) is leading a team of nursing informatics experts from several large health systems who are using a bottoms up approach to identifying standardized nursing content within an information model to create a more comparable, sharable EHR.
- Implementation/Maintenance of EBP – reducing the barriers for nurse leaders to use reports and give near real time feedback to promote uptake and use of EBP by their staff

4. IMPACT

a. Impact on Nursing/Nursing Informatics

- **Impact on support for evidence-based practice***:* Evidence-based practice (EBP), the integration of evidence and research into practice, is a core competency for registered nurses (American Nurses Association, 2015) with the potential to improve patient outcomes. Research has largely focused on nurses' familiarity with EBP, nurses' attitudes and beliefs, nurses' knowledge and skills, and nurses' use of research in practice (Saunders & Vehvilainen-Julkunen, 2016). However, little progress has been made in closing the research-to-practice gap and getting nurses in clinical settings to use evidence to support clinical decision-making (Duffy et al. 2015; Melynk, Fineout-Overholt, Gallagher-Ford, & Kaplan, 2012; Pravikoff, Pierce, & Tanner, 2005; Yoder et al., 2014; Yost et al., 2015). Health care organizations can influence the uptake of best practices through a number of interventions, including formal policies (Oman, Duran & Fink, 2008) and education, but the effectiveness of these strategies are relatively untested. Health information technology may enhance the integration of evidence and reduce the barriers limiting the successful implementation of evidence-based interventions in nursing practice (Gale & Schaffer 2009; Hart et al., 2008), although the scientific basis for the development of tools to support this remains in its infancy (Anderson & Willson, 2008; Staggers, Weir, & Phansalkar, 2008). Implementation processes have been shown to be key to the success and failure of technology-based solutions (Kaplan & Harris-Salamone, 2009), highlighting the benefits of studying the implementation process as an important avenue for research.

- **Impact on nursing-sensitive EHR content & clinical decision support tools:** *Findings from* ***nonparticipant observations, audits, process and outcome metrics***: The customized EHR build supports nurses to conduct and document against a comprehensive and standardized physiologic assessment framework that was developed for use by practicing nurses. The KBN project introduced the use of

established tools for risk and diagnostic screenings for triggering clinical decision support tools that recommend care plans and patient education based on data entry. The build is designed to support the selection of individualized goals and interventions appropriate to the patient. Electronic care planning and patient education functionality is a relatively new development (Kelley, Brandon, & Docherty, 2011) with a potential for improving the quality of care for hospitalized patients. Much of the early research in this area focused on nursing attitudes and perceptions. This research provides much needed empirical/observational evidence to describe how nurses interact with patients and the EHR to impact patient care.

Findings from the Patient Survey: Patient education is designed to engage people in gaining the knowledge, confidence, and skills needed for self-management. Advances in technology hold promise, yet little is known about the impact of technology when it is used to guide nurse-delivered patient education. The KBN care plans are designed to include phenomena-specific teaching topics for patient education. The patient education component of this study evaluated the extent the evidence-based technology guided nurses in screening, assessing learning needs, and delivering personalized evidence-based messages to help patients know and take action for self-care for six nurse-sensitive phenomena. Chart audits and structured interviews with consenting medical/surgical patients were used to capture information about patient characteristics/care, nurse-led teaching, and patient knowledge and use of the recommendations. The technology, along with leader encouragement, supported nurses to assess, identify risks/problems, and deliver explanations during care. The nurses focused on delivering and reinforcing established information rather than assessing for knowledge deficits and involving patients in goal-directed self-care.

- **Impact of using a theory-based D&I approach:** Implementation science offers researchers many useful frameworks, but few are operationalized specifically for evaluating the impact of evidence-based policy innovations by nurses within the context of an acute care hospital. An implementation science framework was adapted to guide this research study focused on outcomes related to hospital-based nursing care. The DIEBP framework (Appendix 3; Adapted from the model by Dodson, et al., 2012) provides a description of the EBP policy implementation process, depicting factors that may impact dissemination, implementation, and associated outcomes. The adapted framework draws attention to the policy process, highlighting the potential impact of health care regulations (big P), health care organizational policy (little p), and the dissemination and implementation options leaders have for deploying EBP policy to impact outcomes. Passive dissemination may be efficient and cost-effective but may not be sufficient to change practice (Hypothesis 1). Implementation may require new and different skills (Hypothesis 2), but may result in better uptake. Ultimately, fewer resources may be needed for quality improvement and service recovery if the uptake of best practices can be maintained. Implementation requires unit leaders to have the knowledge, skills, and capacity for overseeing and maintaining practice changes.
  The DIEBP framework offers a useful tool for health care administrative and unit-based leaders in health care to assess the contextual factors that may impact D&I.

The use of multiple D&I strategies is supported and the important role outcome evaluation plays in the continual improvement of EBP policy for increasing nurse knowledge and use of best practices for optimal outcome achievement is highlighted. Further use and testing of the framework is needed to provide valuable evidence on the factors potentially impacting the success of innovations to improve the uptake of evidence-based practice in health care settings.

- **Implications for Nurse Leaders:** The integration of best practices into clinical care delivery is essential for improving quality of care and patient outcomes. However, it has been shown that nurses' knowledge and use of best evidence for clinical decision-making is often hindered by many factors. Many nurses and nurse leaders are familiar with, have a positive attitude toward, and believe in the value of EBP for improving care quality and patient outcomes, but many still do not use best evidence in practice (Sanders & Vehvilainen-Julkunen, 2016). Melynk (2014) called on nurse leaders and managers to take on new roles including supporting evidence-based care, providing the infrastructure to support it, and role modeling evidence-based decisions. Some nurses have identified that nurse leaders and managers may be barriers to implementing EBP (Melynk, Fineout-Overholt, Gallagher-Ford, & Kaplan, 2012) and that implementing EBP may require nurse leaders to learn develop new knowledge and skills to take these new roles (Gifford, Davies, Graham, et al., 2012).

- **Implications for Health Care Organizations:** Dodson et al. (2012) described evidence-based policy as a continuous process of using the best available evidence to improve health outcomes. Their framework for the dissemination of evidence-based policy was designed to describe the process for enacting "big P" level health policy - referring to the formal laws, rules, and regulations enacted by elected officials. The Research Team adapted the Dodson et al., framework for the dissemination of evidence-based policy for use within a health care organization. The adaptation draws attention to the policy process and highlights that patient care within a health care organization is strongly influenced by three potentially competing inputs: best-practice evidence (dependent on hospital vision), organizational/discipline-based policies ("little p"), and external regulations ("big P") for financial/business success going forward. The current health care environment is strongly focused on reducing cost and 30 day readmission with an increasing demand for patient satisfaction and quality. These external pressures may explain why chief nurses from across the country, recently responded to a survey saying that they had a high value EBP but were not able to identify EBP as a budget priority (Melnyk, Gallagher-Ford, Thomas, Troseth, Wyngarden, & Szalacha, 2016). While most would agree that investing in EBP is important, chief nurses with limited funds but be strategic with their funds. The framework adapted for this study provides a theory-based approach with full range of options that a nurse leader can use to invest evidence-based practices with the greatest change of improving nursing-sensitive outcomes.

b. Impact on Other Disciplines

- **Implications for using a theory-based D&I approach:** This project utilizes an implementation science theory to increase our understanding of how evidence-based

policy is disseminated and utilized within a health care organization. Dodson et al. (2012) describe "Big P" health policy development and dissemination processes as complex with limited ability to predict policy uptake and process outcomes. The issues are similar or even heightened for health care organizations. An increase in health care regulations and demands for improved quality at a lower cost makes it imperative that leaders have vehicles to support them to rapidly influence practice. Health care policy makers must develop effective skills and resources for translating research into policies for guiding clinical practice and for disseminating it in a way that promotes adoption and use of evidence-based practices by key audiences. These efforts require a continued organizational commitment to providing the resources required to implement evidence-based interventions and to assess clinicians' knowledge, skills, and commitment to using evidence-based practice to achieve desired outcomes. Theory-based approaches may assist health care organizations to develop the evaluative methods needed to assess the strengths and limitations associated with implementation strategies.

c. Impact on Knowledge Transfer

- The Knowledge-Based Nursing Initiative started in 2004 as an EHR vendor propriety solution. The vendor provided financial support for the college of nursing and the health care organization to develop phenomena-based knowledge translation documents with actionable recommendations for designing EHR content and clinical decision support (CDS) tools for data fields with secondary use in the creation of reports. In 2010, the health care organization transitioned to a different EHR vendor (Epic Corporation) focused on innovating technology and promoting advancements in content and CDS by facilitating open end-user sharing. This vendor reaches agreements with tool developers to license reliable and valid screening and diagnostic tools for general use. Thus, KBN materials have been shared with other Epic Users to support standardization and the creation of shareable and comparable processes for improved patient care. (Refer to PRODUCTS section)

d. Society Beyond Science and Technology

Five years ago the Institute of Medicine (2011) published a landmark report on the Future of Nursing, concluding that nurses/nursing were capable of taking a greater role in America's health care system and working to the full extent of their profession. The KBN-based patient education functionality is designed to be person-centered, guiding nurses in screening, assessing learning needs, and delivering personalized evidence-based messages to help patients know and take action for self-care, even if it is not being used to the full capacity by nurses today.

5. CHANGES/PROBLEMS

a. Change in Approach

- **Decision to Utilize an Implementation Science Framework**: The original protocol utilized a Logic Model as a guide for program evaluation. In reviewing literature and

attending conferences, the research team became aware of Dissemination and Implementation (D&I) Science, an emerging science aimed at promoting the translation of research results into practice and policy in order to affect population health. This led the Research Team to consider a theory-based approach to increase our understanding for how organizations increase the uptake of evidence-based practices by nurses and how the knowledge and use of these practices improve nurse-sensitive outcomes. The research team utilized the process and inventory of commonly cited models (N=61) established by Tabak et al., (2012) to choose the model with the best fit based on the selection criteria and adapted the framework to accommodate the aim(s), population, and setting). The model was used to guide the design, measurement, and evaluation of the findings. A manuscript and a book chapter have been submitted for publication of this component of the study.

- **Best Practice Maintenance Strategies- Comparing Usual Care with eMonitoring:** The original design for the multimodal implementation intervention included: audit/feedback, training, and unit-level implementation and head-to-head comparison of two different strategies for monitoring implementation. Units at the primary site were randomized into two different maintenance strategies:
  Group A: Directed to use usual practices to monitor and support implementation
  Group B: Received additional training to access and do "eMonitoring" using a daily Epic-based electronic report ("Key Performance Indicator" (KPI) Unit Details. This report provides a list of every patient on the unit with patient and care details, posted daily by 0700 with details accurate from midnight on the day of the report. The unit leaders and preceptors were trained on use but encountered difficulties in using the reports when the reports were delayed (between 8-10am). Multiple interventions were tried to improve performance (rewriting the code, breaking the reports up into smaller sections, adjusting the timing of other reports, etc) to get access to the report in time for daily rounds. The delay problem was finally resolved with the installation of a new server (hardware) in January of 2015 – halfway through the intervention period for the primary site. Both community hospitals were assigned to Group B and received training on the use of the eMonitoring reports. The reports were available by 7 am but the leaders did not adopt their use.
  Conclusion: No units adopted the use of eMonitoring – so the evaluation of varied maintenance strategies was not able to be carried out.

b. Changes in Expenditures

- **Leadership Education:** The original protocol included a plan to engage additional system-wide nurse leaders (N=50) in EBP training. During the preliminary meeting with System Nursing Leaders, the leaders revealed that they support the use of EBP but were not engaged in using the electronic health record or overseeing clinical practice at the level required for study participation. This activity was not carried out.

- **Replication:** The KBN Team recognized that this study offers a unique approach – going beyond gathering self-reports from nurses about their interest and knowledge of EBP and the use of best practices and technology to actually observing what nurses do during patient care. This approach was novel but labor-intensive, so our initial

protocol was limited to evaluating care at one large but diverse site. We were, however, committed to conserving resources during the first two years of the study. We found that we had a sufficient amount of unused funds to support study replication at least one more facility to optimize generalizability if we were able to get approval from the sponsor to repurpose and extend our study time. A proposal was submitted and approved prior to the start of the replication period.

c. Human Subjects Protocol Changes

Protocol Title: "The Impact of Electronic Knowledge-Based Nursing Content and Decision-Support on Nursing-Sensitive Patient Outcomes"

Approvals/Continuing Reviews to Data:

- Aurora IRB Approval #13-142E 20-Dec-2013: Updated with Waivers 03-JAN-2014
- Aurora IRB Continuing Review of Expedited Study (Exp Cat 5 & 7) Approvals received: 24-NOV-2014 (Year 1), 24-NOV-2015 (Year 2), and 26-SEPT-2016 (Year 3)
  NOTE: The KBN Impact Study is closed for subject enrolment but remains open for ongoing analysis with the AHC IRB.
- Human Research Protections Office (HRPO) Approval Log No. A-17696 EDMS #5648 21-Feb-2014; Approved Continuing Review documents with updated protocol acknowledged 19-DEC-2014 (Year 1), 23-NOV-2015 (Year 2), & 6-OCT-2016 (Year 3).
  NOTE: The USAMRMC ORP HRPO sent an email (received 12/23/2016) indicating that DoD support for this project has ended, no further review of the protocol will be conducted, and the HRPO protocol file will be closed. Any reporting to the HRPO outlined in the protocol will no longer be required.

Study Protocol Modifications:

- AHC IRB Modification #1 –Ketchum added (completed CITI Training & Orientation) – Approved 08-JAN-2014
- AHC IRB Modification #2 – Removing Hartwig/Mills, updating *Patient Survey question with review of Unit Recruitment Video – Approved 31-JAN-2014
- AHC IRB Modification #3 – Review of *observation/audit forms - approved 03-FEB-2014
  *Note – Final/AHC IRB approved versions of the Patient Survey and Nonparticipant and Audit forms were forwarded to HRPO prior to final approval
- AHC IRB Modification #4 - Updated HRPO address with Patient Consent edits requested by HRPO – Approved 28-FEB-2014
- Study Protocol and AHC IRB approved documents with HRPO edits were reviewed by Patricia Shank, CTR for US ARMY MEDCOM for review
- Study Protocol submitted to HRPO - Dr. Laura R. Brosch, RN, PhD, Director of the Human Research Protection Office (HRPO) Office Approved 21-FEB-2014
- Aurora IRB acknowledged received of HRPO Approval Letter– 24-FEB-2014
- AHC IRB Modification #5 with final Nurse Survey with Learning Connection ppt to introduce survey - Approved 25-MAR-2014
- AHC IRB Modification #6 to add Interim RN Data Collector (completed CITI Training and Orientation) with updated PI Address (moved to new location)– Approved 10-APR-2014

- AHC IRB Modification #7 to add Project Manager (Nikolic) and Research Scientist (Badger) (completed CITI Training/Orientation) with revised fliers for Nurse Survey recruitment – Approved 03-JUN-2014
- AHC IRB Modification #8 with updated IRB Document and Study Protocol (Version #3 – 06-NOV-2014) with updated conceptual framework and details about randomization plan, optimization training, and unit implementation. The Nurse Information Letter and Patient Consent forms were updated with PI address change. Added Research Scientist (Martens) (completed CITI Training/Orientation) to replace Bauer (resigned) Approved 20-NOV-2014
- AHC IRB Modification #9 with updated Study Protocol (Version #4 – 09-FEB-2015) with editorial changes to enhance background and process description, updated observations and audit forms to capture data that were written in during baseline assessments, updated fliers and other study materials with revised PI contact information, updates to the Nurse Survey Learning Connection module in preparation for use during post-intervention assessment. Updated role for research scientist (Badger) to include recruitment, consent, and data collection of Patient Survey (in place of Bauer) and added clinical advisor (Marzinski – Site Magnet Coordinator) for limited hours to support tracking of unit-based implementation including preceptor staff use of maintenance tools and tracking form. Approved 15-FEB-2015
- AHC IRB Modification #10 with updated flier and email to introduce the Nurse Survey Approved 14-MAY-2015
- AHC IRB Modification #11 with updated Study Protocol (version #5 – 28-MAY-2015) proposing the addition of two small community sites to increase the diversity of our sample and broaden generalizability. Proposed to add four additional inpatient nursing units, 90 nurses and 80 patients. Also updated recruitment video script and Nurse Information Letter to include information about the two new sites. Approved 28-MAY-2015
- AHC IRB Modification #12 with Personnel Changes (Resignation Badger/Rehire Bauer) submitted 9-OCT-2015
- AHC IRB Modification #13 with updated Appendix D fixing typo regarding the assignment plan for South Region. Approved 13-APR-2016
- AHC IRB Modification#14 with Personnel Changes (Nikolic Resignation; Study Role Completion for Jeske, Kadlec, and Marzinski with updated Contact Person (PI) Approved 13-JUNE-2016
- AHC IRB Modification #15 – Study closed to accrual – 03-AUG-2016

6. PRODUCTS

a. Publications, conference papers, and presentations

Note: Palese, Coletti & Dante (2013), in their systematic review of publication efficiency for nursing journals, reported the time between data collection and publication averaged 981 days (95% CI 929-1032 day) and that publication required significant process& skill.

- **Invited Book Chapter re: Case Study on Model Selection and Adaptation**
  Tabak, Rachel, Chambers, David, Hook, Mary. (In review). The Conceptual Basis of Dissemination and Implementation Research: Lessons from Existing Models and Frameworks. In Brownson, R. C., Colditz, G. A., & Proctor, E. K. (Eds.), *Dissemination and implementation research in health: Translating science to practice* (2nd Edition – in development). New York: Oxford University Press.
  Submitted: 28-DEC-2016
  Note: One of the authors (Dr. Ross Brownson) of the original study framework (Dodson, Brownson, &Weiss) reviewed our manuscript and presentation for Academy Health. He reported that he was working on a second edition of his D&I science textbook and asked if we could prepare a brief ((<800 word) case study for a chapter written by Dr. Rachel Tabak (author of the selection process that we used). We are expecting to publish the primary paper in a journal with all the details so the case study will cite a primary source.

- **Journal publications (peer-review journal w/ acknowledgement of federal support):**

  Hook, M.L., Bauer, W.S. (In review – Manuscript # WVN 12-012). Adapting a Framework for Evaluating the Impact of an Electronic Evidence-based Policy Innovation for Nurses in Acute Care. Submitted to *Worldviews on Evidence-Based Nursing*.
  Submitted: JAN-2017
  Note: This manuscript was submitted to two journals that focus on D&I research: *Implementation Science* (11/2016 IMPS-D-16-00694) and the *International Journal of Nursing Studies* (IJNS-D-17-00051) but not accepted.

  Hook, M.L., Bauer, W.S. (In development). The Impact of a Technology-based Intervention to Support Evidence-based Patient Education by Nurses in Acute Care"
  Target Journal: *Worldviews on Evidence-Based Nursing*
  Goal for submission: 6-FEB-2017

  Hook, M.L., Bauer, W.S., Gentile, D., Giannini, R. Hoffmann, M.L., Ketchum, B., & Singh, M. (In development). Investigating Nurse Knowledge and Use of Evidence-Based Practices at the Bedside: A Mixed Methods Approach in Acute Care
  Target Journal*: Computers, Informatics, Nursing (CIN)*
  Goal for submission: 6-MAR-2017

  Results: Hook, M.L., Bauer, W.S., Gentile, D., Giannini, R. Hoffmann, M.L., Ketchum, B., Kingston, M.B. & Singh, M. (In development).
  Target Journal: *TBD*
  Goal for submission: 3-APR-2017

- **Conference Presentations (Regional and National Conferences - 11)**

Podium (8): (all acknowledged federal support)

Bauer, W.S. (2017, April). *The Impact of a Technology-based Innovation to Support Evidence-based Patient Education by Nurses in Acute Care.* Accepted for podium presentation at the 41st Annual Midwest Nursing Research Society (MNRS) Conference, in Minneapolis,MN.

Hook, M.L. (2016, Dec). *Using Implementation Theory to Evaluate the Impact of Technology on Nurses' Knowledge and Use of Best Practices in Acute Care.* Podium presentation at the 9th Annual National Institutes of Health and *AcademyHealth* Conference on the Science of Dissemination and Implementation (Models, Measures, and Methods Track), Washington, D.C.

Hook, M.L. (2016, May). *Investigating the Impact of Technology on Nurses' Knowledge and Use of Evidence-Based Practice in Acute Care.* Breakout Session at the 18th Annual Building Bridges to Research Based Nursing Practice, Milwaukee, WI.

Hook, M.L. (2016, March). *Using a Mixed Methods Design to Investigate Adherence to Evidence-Based Nursing Practices in Acute Care*. Presentation at the Midwest Nursing Research Society's 40th Annual Research Conference, Milwaukee, WI

Hook, M.L., Giannini, R., Hoffmann, M.L. Ketchum. (2015, September). *Using Implementation Theory to Study How Technology Supports Best Practice*. Presentation at the 2015 Epic Fall Users Group National Meeting, Verona, WI.

Hook, M.L., Giannini, R., Hoffmann, M.L. Ketchum. (2015, September). *Investigating Adherence to Evidence-Based Practice at the Bedside*. Presentation at the 2015 Epic Fall Users Group National Meeting, Verona, WI.

Hook, M.L., Giannini, R., Hoffmann, M.L. Ketchum. (2015, September). *Using Implementation Theory to Study How Technology Supports Best Practice*. Presentation at the 2015 Epic Fall Users Group National Meeting, Verona, WI.

Hook, M.L. (2015, May). *Using Implementation Theory to Evaluate the Impact of Technology on Use of Evidence-Based Practice and Outcomes in Acute.* Podium presentation at the 17th Annual Building Bridges to Research Based Nursing Practice, Milwaukee, WI.

Poster Presentations (3) – all acknowledged federal support

Hook, M.L., Bauer, W.S. (2016, December). *Using a Mixed Methods Design to Investigate Adherence to Evidence-Based Nursing Practices in Acute Care.* Poster presented at the 9th Annual Conference of the Science of Dissemination and Implementation, Co-hosted by the National Institutes of Health and AcademyHealth, Washington, DC.

Hook, M.L., Badger, M.K., (2015, April). *Using Implementation Theory to Evaluate the Impact of Technology to Support Evidence-Based Practice and Patient Outcomes in Acute Care.* Poster presented at the 39th Annual Midwest Nursing Research Society Research Conference, Indianapolis, IN.

Bauer, W.C., Hook, M.L. (2014, May). *Measuring the impact of evidence-based patient education on patient knowledge and behavior in acute care*. Poster presented at the 16th Annual Building Bridges to Research Based Nursing Practice, Milwaukee, WI.

b. Technologies or techniques

- **Epic Corporation Nursing Collaborative Group**
  The Aurora Knowledge-based Nursing Informatics Team members have been actively participating in work groups led by the Epic Corporation for organizations using Epic-based electronic health record systems. The Epic "Nursing Collaborative" is a collective of nurse leaders formed to develop end-to-end workflow toolkits for nursing quality indicators. the goal is to apply evidence-based practices, as well as best practices, to our Foundation System and provide the Epic community with recommendations for a clinical program designed around specific indicators. The Aurora Team led a team that worked on Pressure Ulcer/Injury Prevention and participated on teams for fall prevention, delirium, and handover. KBN best practices for content, clinical decision support, and leadership reporting were included in the toolkits that were produced for these topics.

- **University of Minnesota – Nursing Knowledge: Big Data Science Workgroup**
  In 2013, the UM held an invitation conference with national experts in nursing informatics with the intent of creating a vision and strategies to achieve better health outcomes by standardizing and integrating the information nurses gather in electronic health records and other information systems. These data are often the primary source for insights and evidence for preventing, diagnosing, treating and evaluating health conditions and contextual data about patients, including environmental, geographical, behavioral, imaging, and more, will lead to breakthroughs for the health of individuals, families, communities and populations. The Aurora Informatics Research Team are participating in several workgroups, sharing information about KBN-based content and decision support to inform, gain consensus, identify opportunities for standardization, and test new ideas. Current efforts involve two key phenomena that are the focus of the current study: pain and skin integrity care.

c. Inventions, patents, and/or licenses – None to report

d. Other Products – None to report

7. PARTICIPANTS & OTHER COLLABORATING ORGANIZATIONS

Personnel Name	Project Role	Contribution to the Project
Mary Hook, PhD, RN-BC Research Scientist	Principal Investigator; Research Team Leader	Directed project for intellectual content, operational and budgetary management, deliverable achievement, adherence with IRB requirements, and dissemination
Nichole Nikolic, BA (2014-2016) **Janeen Hartwig Phillips, BA** (2013-2014)	Project Manager	Contributed organizational and project planning expertise; Worked with PI to ensure all aspects of project plan was coordinated & performed effectively - on time including administrative reported; Facilitated all communication among project participants. Facilitated IRB-related processes including recruitment of nursing units; Provided leadership for all aspects of baseline and post-intervention data collection, particularly for unit and nurse demographics, processes and outcomes; Provided leadership and expertise in carrying out all aspects of the Optimization Training delivery; Provided support for dissemination of baseline findings with internal and external audiences.
Rose Giannini, MSN, RN-BC Nursing Informatics Specialist and Nursing Informatics Manager	Research Team Member	Contributed nursing and nursing informatics expertise; Provided leadership and management expertise; Worked with the KBN Consultant and the Research Team to identify best practices for the selected phenomena. Supported the development of the non-participant observation data collection; Performed non-participant observations per

Personnel Name	Project Role	Contribution to the Project
		protocol; Supported curriculum development for Optimization Training and served as an instructor for sessions at all sites
Mary Lou Hoffmann, MS, RN, ACNS-BC Clinical Nurse Specialist and Nursing Informatics Specialist	Research Team Member	Contributed clinical nurse specialist and nursing informatics expertise; Worked with the KBN Consultant and the Research Team to identify best practices for the selected phenomena. Supported the development of the non-participant observation data collection; Performed non-participant observations per protocol; Supported curriculum development for Optimization Training and served as an instructor for sessions at all sites
Brandy Ketchum, MSN, RN Nursing Informatics Specialist	Research Team Member	Contributed clinical nurse specialist and nursing informatics expertise; Worked with the KBN Consultant and the Research Team to identify best practices for the selected phenomena. Supported the development of the non-participant observation data collection; Performed non-participant observations per protocol; Supported curriculum development for Optimization Training and served as an instructor for sessions at all sites
Wendy Bauer, BSN, RN Graduate Research Assistant (2013) Research Scientist (2014-2016)	Research Team Member	Contributed nurse and research expertise; Assisted the PI in gathering literature to support the development and testing of baseline and post-assessment measures. Supported the development of

Personnel Name	Project Role	Contribution to the Project
		the Patient Survey data collection tools and procedures; Screened and recruited patients for the Patient Survey per protocol at ASLMC/baseline; Assisted with data abstraction, entry into SurveyMonkey, downloads into excel, and data cleaning for optimal accuracy; Contributed scientific and writing expertise to support dissemination of findings and recommendations.
Deb Gentile, PhD, RN-BC Research Scientist	Research Team Member	Contributed nursing and research expertise; Worked with the KBN Consultant and the Research Team to identify best practices for selected phenomena. Assisted the PI in gathering literature to support the development and design of the study including measures, with specific input re: the development and evaluation of the Nurse Survey. Worked with the KBN Consultant and the Research Team to identify best practices for the selected phenomena. Contributed scientific and writing expertise to support dissemination of findings and recommendations.
Mary Lynn Martens, PhD, RN (2014-2016) Research Scientist	Research Team Member	Provided nursing and research expertise; Supported the development and maintenance of the data collection tools & procedures; Assisted with data abstraction, entry into SurveyMonkey, downloads into excel, & data cleaning for optimal accuracy; Contributed scientific and writing expertise

Personnel Name	Project Role	Contribution to the Project
		to support dissemination of findings and recommendations.
Martha Badger MSN, RN-BC, CPHIMS (2014-2015) Research Scientist	Research Team Member	Contributed nursing and research expertise; Supported the maintenance of the data collection tools and procedures; Assisted with data abstraction, entry into SurveyMonkey, downloads into excel, and data cleaning for optimal accuracy; Contributed scientific and writing expertise to support dissemination of findings and recommendations.
Maharaj Singh, PhD Biostatistician	Biostatistician/Research Team Member	Contributed research and statistical analysis expertise; Supported PI to design and create statistical analysis plan. Supported the PI to upload data and conduct analyses for baseline assessment and evaluate post-intervention findings by unit-type. Contributed scientific and writing expertise to support dissemination of findings and recommendations.
Jan Mills, BS, RN (2013) Staff Nurse Nursing Informatics	Nursing Care Expert; Informatics Expert; Research Team Member	Contributed clinical and nursing informatics expertise during the initial phases of the study. Worked with the KBN Consultant and the Research Team to identify best practices for the selected phenomena.
Pat Kadlec, BSN, RN Staff Nurse, Diversified Staffing Services	Staff Nurse Data Collector	Performed non-participant observations for patient admissions per protocol for all sites.
Erin, Kidd Applications Development Manager (with Assigned Programming Staff)	IT/clinical documentation design and build consultant	Contributed leadership, oversight and support for the KBN content/function in the Epic-based EHR ("SmartChart"); Assigned work and provided oversight for building and

Personnel Name	Project Role	Contribution to the Project
		troubleshooting nursing-based documentation at AHC
Kevin Underwood Reporting Application Development Manager	IT/data management and reporting consultant	Contributed leadership, oversight and support for KBN content in the Epic-based EHR ("SmartChart") Reports; Assigned work and provided oversight for building and troubleshooting reports at AHC
Leadership Advisors		
Mary Beth Kingston, MSN, RN, NEA-BC Executive Vice-President and Chief Nursing Officer for Aurora Health Care (System)	Senior Leader and Study Advisor	Contributed leadership and operational support the KBN Research Team for the project; Supported dissemination of the findings and recommendations.
Faye Zwieg, MBA, BSN, RN Vice President and Chief Nursing Officer at Primary Study Site	Senior Leader and Study Advisor; Patient Care Manager Advisor (ASLMC)	Contributed leadership and operational support the KBN Research Team for the project at her site; Contributed management input into the assessment plan and the deployment of the intervention as identified, especially as it relates to manager training in KBN concepts and use of electronic reports. Support dissemination of the findings and recommendations.
Holly Schmidtke, MBA ,BSN, RN,CNML Vice President and Chief Nursing Officer at Aurora Lakeland Medical Center and Aurora Memorial Hospital at Burlington	Senior Leader and Study Advisor	Contributed leadership and operational support the KBN Research Team for the project at her site; Supported the dissemination of the findings and recommendations.
Clinical Advisors		
Lee Jeske, RN, GCNS-BC (2013-2015) Director of Advanced Practice, Aurora St. Luke's Medical Center	Clinical/Nurse Management Advisor	Contributed leadership, operational support and clinical expertise in planning and executing the assessment and optimization interventions. Served as a strategic/executive liaison between the Research Team & site Leaders, Nursing Leadership Council, and the

Personnel Name	Project Role	Contribution to the Project
		Clinical Nurse Specialist Group; Supported the dissemination of findings and recommendations.
Deb Kastenholz, MSN, RN, CRN (2014-2015) Clinical Nurse Specialist (CNS)	Clinical Nurse Advisor	Contributed leadership, operational support and clinical expertise in planning and executing the baseline and f/u assessments; Served as a liaison between the Research Team and ASLMC CNSs and the Site-Based Nursing Leadership Council. Supported the dissemination of findings and recommendations.
Jane Meitler, MSN, RN, ACNS-BC, RN-BC (2014-2015) Clinical Nurse Specialist (CNS)	Clinical Nurse Advisor	Contributed leadership, operational support and clinical expertise in planning and executing the baseline and f/u assessments; Served as a liaison between the Research Team and ASLMC CNSs and the Site-Based Nursing Leadership Council. Supported the dissemination of findings and recommendations.
Sara Marzinski, BSN, RN, CCRN Magnet® Program Manager Aurora St. Luke's Medical Center	Clinical Nurse/Magnet QI Advisor	Contributed leadership, operational support and clinical expertise in planning and executing the unit-based implementation of priority projects.
Brenda G. Larkin, MS, RN, ACNS-BC, CNS-CP, CNOR Clinical Nurse Specialist for Perioperative Services	Clinical Nurse Advisor	Contributed leadership, operational support and clinical expertise in planning and executing the baseline and f/u assessments Served as a liaison between the Research Team & Site-Based Nursing Leaders. Supported the dissemination of findings and recommendations.

Personnel Name	Project Role	Contribution to the Project
Mary Casey, RN, BSN, MBA Director of Environmental, Food and Nursing Services	Patient Care Manager Advisor	Contributed management input into the assessment plan and the deployment of the intervention as identified, especially as it relates to manager training in KBN concepts and use of electronic reports. Supported disseminating the findings and recommendations for internal and external audiences.

Consultants		
Dr. Elizabeth Devine, PhD, RN, FAAN	Research Consultant - KBN Synthesis	Supported the Team to review Knowledge-based Nursing Synthesis documents and identify best practices for the focus of the study.
Dr. Dawn Dowding PhD RN, FAAN	Research Consultant – Clinical Decision Support	Contributed research, informatics and clinical decision support, and writing expertise; Supported disseminating the findings and recommendations for internal and external audiences.
Christine McLaughlin	Consultant – Scientific Writer	Contributed knowledge and expertise about group writing to support the Research Team to dissemination by developing a template and some initial posters and manuscripts.

Other Collaborations: Federal Military Advisory Council

Active 2013 through 2015

Accomplishments Year 1 - 2013

- Established a collaborative relationship with LTC Michael Ludwig, RN-BC, MS, CPHIMS, AMEDD Chief Nursing Information Officer, Ollie B. Gray RN, MSN, PMP Executive Healthcare Manager, AITG for TATRC and members of the Federal Nursing Informatics iEHR Collaborative
- Orientation meeting (conf call) was held with LTC Ludwig and associates – MAR-2013

- LTC Michael Ludwig set-up kick-off /orientation meeting with DOD Nursing Information iEHR Collaborative Meeting – 28-MAY-2013; Research Team worked with LTC Michael Ludwig to plan subsequent meetings (July 31 2013) and draft a Advisory Council Charter.
- Advisory Council call was help on 30-AUG- 2013; Each branch stakeholder described that they had a unique approach for supporting evidence based practice within their branch. The group suggested that the PI meet with each branch to identify similarities/differences within military and with civilian study site (to support study application). An assessment form was developed and distributed to gather details from each branch during upcoming interviews.
- Navy Branch Meeting call was held on 23-OCT-2013; Captain Joel Parker led the discussion re: KBN research project and asked for Navy Nurses input. The Navy reps discussed that they were building their documentation system with best practices and associated protocols, etc. for cross military/cross discipline use. All agreed re: the need for strategies to ensure adoption and evaluation with informatics build to ensure that the tools were working to support staff to effectively achieve outcomes. Uncertain re: regarding next steps.
- December check-in conference call was held 13-DEC- 2013 with Federal Advisory Council. None of the other branch stakeholders completed the assessment. (Assessment deferred)

Year 2 - 2014

- The KBN Research Team continued to collaborate with the Federal Military Advisory Council led by LTC Michael Ludwig, RN-BC, MS, CPHIMS, Officer in Charge to the Presidential Medical Evaluation Treatment Unit - OIC METU and the members of the Federal Nursing Informatics iEHR Collaborative.
- Conference Calls were held quarterly to update the group regarding study progress including 24-JAN-2014 to describe recruitment; 7-APR-2014 to describe baseline data collection 15-AUG-2014 to describe baseline results and intervention plan. The group discussed the ways to share relevant findings within the military. LTC Seeley suggested study could be presented at the 2015 Defense Health Information Technology Symposium.

Year 3 - 2015

- The collaboration with the Federal Military Advisory Council continued in 2015
- Conference call was held on 20-APRIL-2015. The PI presented details about the active intervention and plans for reassessment. Advisory Group members discussed the status of the military's efforts to select a new EHR. They were unclear about the link between the study and their work, especially given EHR platform changes in progress.
- Conference call on 18-NOV-2015 with LTC Ludwig 18-NOV-2015. He reported his role had changed and no longer could provide a link to the Advisory Council.
- PI provided an update re: status during In-Person Review at Fort Detrick (1-DEC-2015). Opportunities to present findings to military personnel will be determined at end of project.

The Impact of Knowledge-Based Nursing (KBN) Content & Decision-Support on Nursing-Sensitive Patient Outcomes

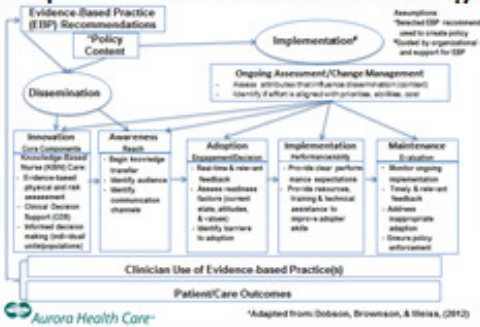
MRMC Log Number: ERMS 12163001 Award#W81XWH1310034

PI: Dr. Mary Hook, PhD, RN-BC **Org: Aurora Health Care** **COR: Tony Story** **Total Funding: $1.5M**

Study/Project Aim/Approach

- **Problem:** Advances in the use of electronic evidence-based (EB) content and clinical decision support tools for nursing is untested.
- **Approach:** This pre/post mixed methods study was conducted to evaluate the impact of embedding EBP recommendations into policy and the electronic health record (EHR) to support nurses to know and use best practices to improve patient outcomes. The Dissemination of Evidence-based Policy Framework (Dobson, Brownson, & Weiss, 2012) was adapted and guided the study, proposing that the impact of an EBP innovation is influenced by how it is deployed. The study was conducted at one large quaternary medical center (N=23 inpatient units) and replicated at two community facilities using no-cost extension mechanism to enhance size and generalizability of the findings.
- **Military Relevance:** This effort is consistent with military hospital goals for enhancing the quality of nursing care and reducing patient care costs.

Conceptual Framework for Disseminating & Implementing EBP



Implementation theory suggests that evidence based practices require implementation including adoption and maintenance to achieve best outcomes

Accomplishments: This framework was adapted by the KBN Team with input from international implementation science experts during the 2014 Training Institute for Dissemination and Implementation Research in Health (TIDIRH) sponsored by the National Institutes of Health .

Timeline, and Cost

Activities: Study Milestons FY	FY13	FY14	FY15	FY16
1 - Identify essential knowledge & nursing practice behaviors				
2 – Validate KBN electronic tool function				
3 - Develop measures & procedure for evaluating implementation and adoption of KBN practices (w/ AHC IRB & HRPO Approval)				
4 - Conduct baseline measurement to identify gaps to improve KBN intervention study and analyze findings				
5 - Design the intervention study strategy and delivery method				
6 – Deliver the intervention study at ASLMC				
7 - Complete tracking progress on the intervention				
8 - Complete full evaluation (post-intervention assessment & analysis)				
Maintained ongoing relationship with Federal Military Advisory Council	Held Quarterly Meetings			
No cost extension - replicating study at 2 community hospitals (objectives 4, 6, 7 & 8				
Estimated Total Budget ($M)	**$458**	**$632**	**$465**	**no cost**

*No cost extension: Unused funds (est=$120K) were approved to be repurposed to replicate study at (2) community sites to enhance generalizability.

Goals/Milestones

Objectives 1 & 2: Identified "essential" EB knowledge/practice behaviors for key problems: pain, delirium, medication non-adherence, depression, risks for fall/injury & pressure ulcers w/ function check

Objective 3: Used implementation science conceptual framework (above) to guide the design of a measures and procedures for pre/post mixed methods study design to evaluate knowledge, use of EB behaviors, & outcomes at a large medical center (N=23 units) and two community hospitals (N=4 units)

Objectives 4-6: Conducted baseline unit assessments to evaluate KBN deployment with EB dissemination; Sample: 27 units, Nurse Leaders, Staff Nurses and patients to identify gaps. Designed Intervention using audit/feedback, optimization training, & unit implementation with varied maintenance strategies (usual vs. electronic monitoring)

Objective 7: Track/support unit implementation progress

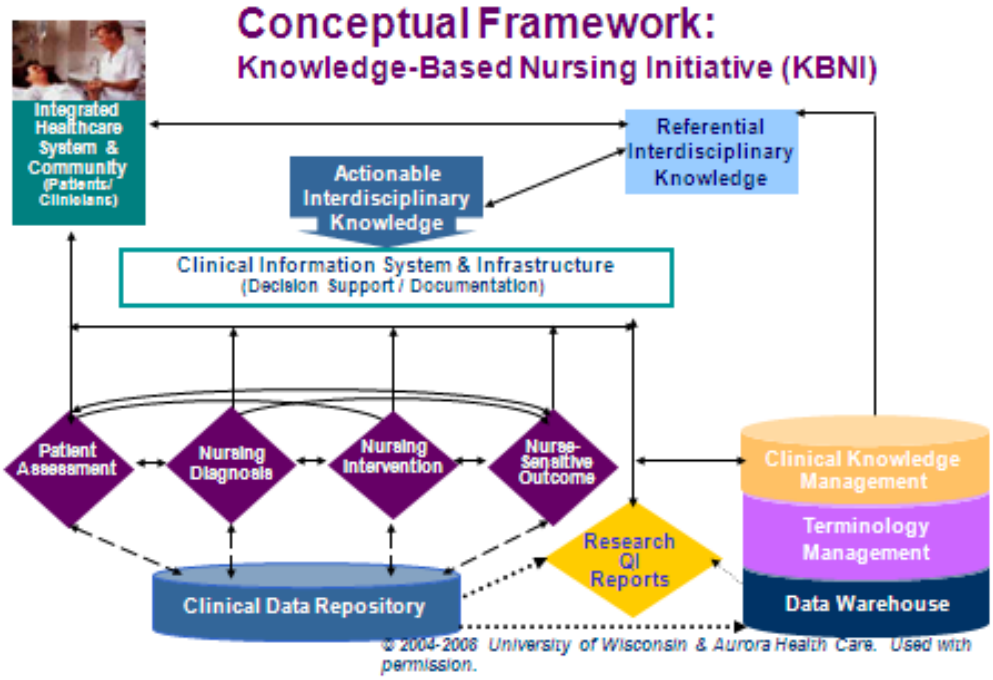
Objective 8: Post-intervention assessment: Site 1 completed July 2015, Sites 2 & 3 completed May 2016. Mixed methods analysis of context, knowledge, use of EB behaviors, patient survey & outcomes completed. Dissemination is in progress with a book chapter & several manuscripts.

27-OCT-2016

APPENDIX A. Knowledge-Based Nursing – Definition and Conceptual Framework

Knowledge-based Nursing (KBN) refers an electronic evidence-based innovation developed by the collaborative efforts of three business partners representing an integrated health care organization, an electronic health record (EHR) vendor, and an academic college of nursing (Lang et al., 2006; Kerfoot, et al., 2008).

- The goal of the innovation was to infuse research/evidence-based nursing content within the workflow to support clinical decision making, populate data repositories, conduct analyses, and improve patient care across all venues.
- A process model (below) was created to depict how evidence is translated evidence into actionable recommendations and used to guiding care planning and practice.
- The recommendations are reviewed and approved by organizational policy decision-makers and used to develop policy and the content of the EHR. The content includes phenomena-specific concepts and customized workflows with reference material, clinical decision support (CDS) tools, care plans, and patient education to guide evidence-based nursing care (Hook, Burke, & Murphy, 2009; Murphy, Harper, Devine, Burke, & Hook, 2011).



- Nurses and nurse leaders receive formal knowledge and hands-on training in the use of KBN-based processes during their initial EHR training (3 – 8 hour class days) and on-unit orientation in the form of on-line training modules. Inpatient nursing units have established communication pathways for disseminating organizational polices and procedures to staff including on-line access, email, unit postings, communication board/binder, huddles, staff meeting announcements, newsletters, and unit-websites.

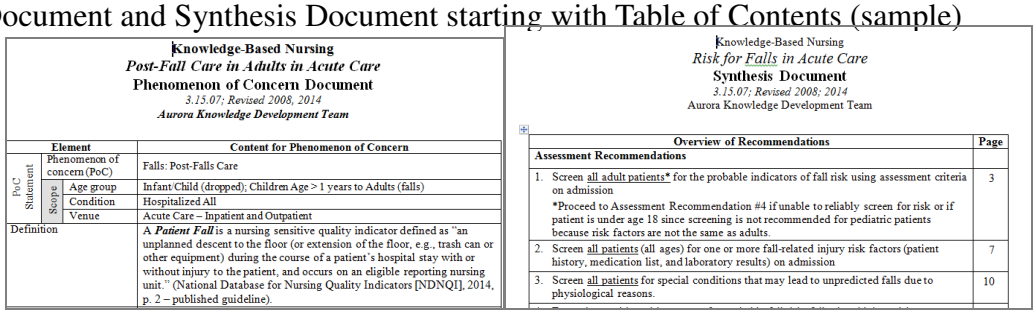
Note: The Logic Model and Conceptual Model for Using Evidence-based Interactions to Engage Patients have been removed to focus report on primary content.

APPENDIX B. Knowledge-based Nursing (KBN) Core Concepts

Knowledge-Based Nursing (KBN) is built on three key components: a clinical information system (EHR), an accountability-based policy infrastructure, and the presence of evaluation mechanisms to monitor and support nursing-process-based decision making.

Core Concepts of the KBN Innovation

1) **Evidence Summaries** focus on practices related to the independent role of the nurse:
   - "Phenomena of Concern" (POC) Documents (below) details the scope of the review including age, condition, venue, definition, and significance (internal/external rationale)
   - "Synthesis" documents contain actionable recommendations based on nursing process:
     - Assessments: history and physical/psychosocial findings (with tools as appropriate)
     - Diagnosis: Risk and/or actual problems
     - Interventions: Monitoring for changes in status, intervening to prevent risk or manage problem, and engaging patient and family to support self-management
     - Outcome evaluation for achievement by the close of the inpatient stay
   - POC Document and Synthesis Document starting with Table of Contents (sample)



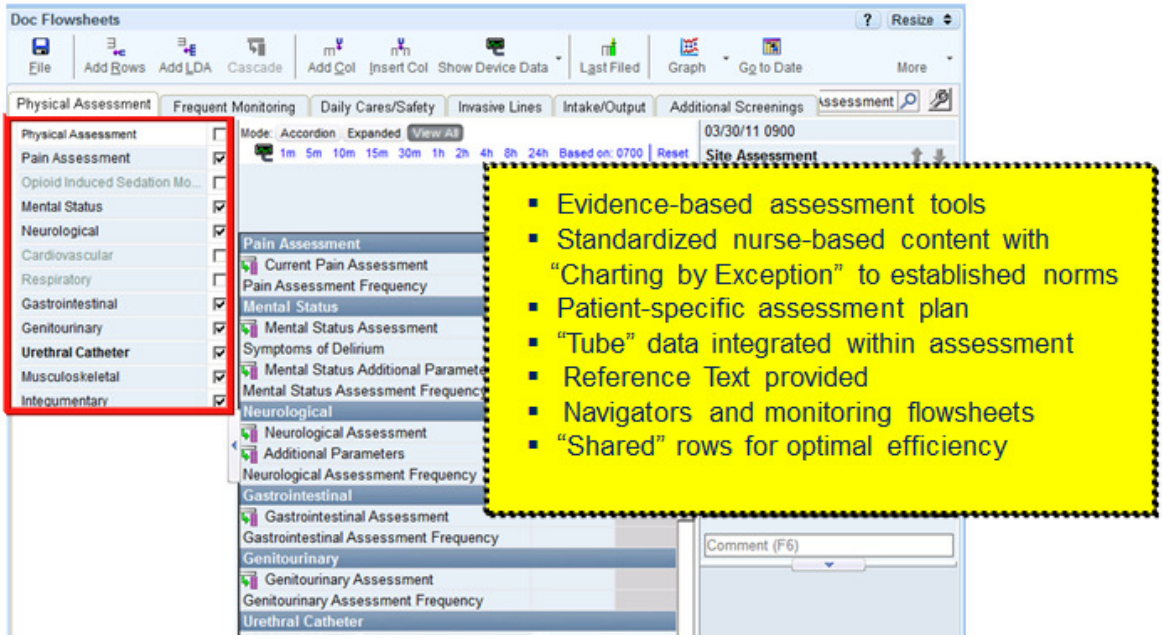
Knowledge-Based Nursing
Post-Fall Care in Adults in Acute Care
Phenomenon of Concern Document
3.15.07; Revised 2008, 2014
Aurora Knowledge Development Team

	Element	Content for Phenomenon of Concern
PoC Statement	Phenomenon of concern (PoC)	Falls: Post-Falls Care
Scope	Age group	Infant/Child (dropped); Children Age > 1 years to Adults (falls)
Scope	Condition	Hospitalized All
Scope	Venue	Acute Care – Inpatient and Outpatient
Definition		A ***Patient Fall*** is a nursing sensitive quality indicator defined as "an unplanned descent to the floor (or extension of the floor, e.g., trash can or other equipment) during the course of a patient's hospital stay with or without injury to the patient, and occurs on an eligible reporting nursing unit." (National Database for Nursing Quality Indicators [NDNQI], 2014, p. 2 – published guideline).

Knowledge-Based Nursing
Risk for Falls in Acute Care
Synthesis Document
3.15.07; Revised 2008; 2014
Aurora Knowledge Development Team

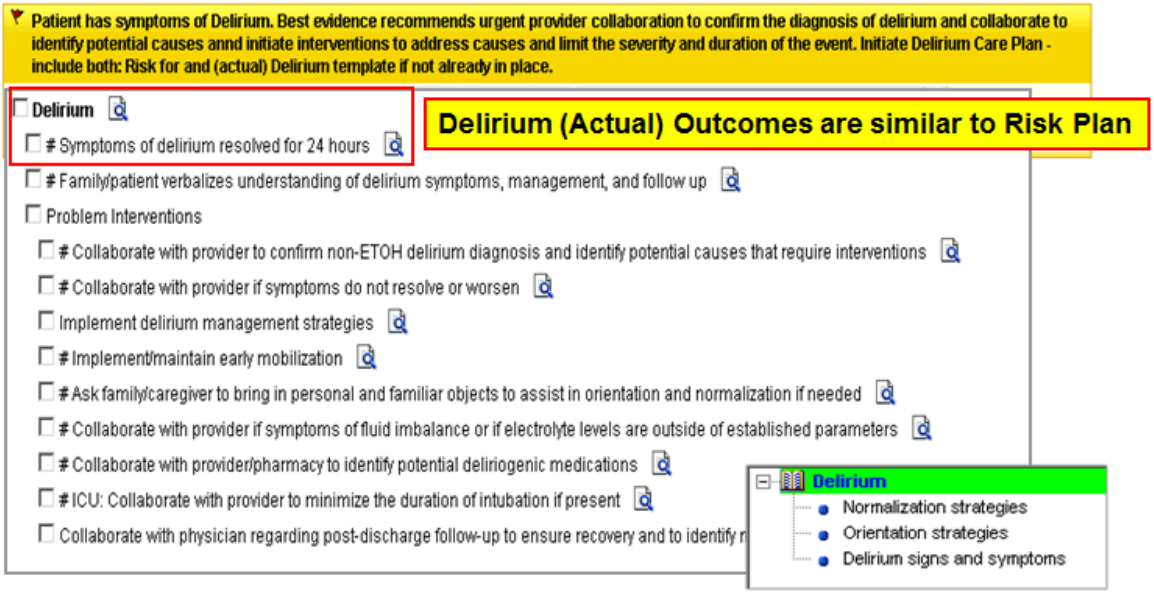
Overview of Recommendations	Page
Assessment Recommendations	
1. Screen all adult patients* for the probable indicators of fall risk using assessment criteria on admission *Proceed to Assessment Recommendation #4 if unable to reliably screen for risk or if patient is under age 18 since screening is not recommended for pediatric patients because risk factors are not the same as adults.	3
2. Screen all patients (all ages) for one or more fall-related injury risk factors (patient history, medication list, and laboratory results) on admission	7
3. Screen all patients for special conditions that may lead to unpredicted falls due to physiological reasons.	10

2) **Standardized Assessments drive clinical decision-making**
   - Standardized assessments including reliable/valid tools to screen for risks/problems
   - Documented findings trigger clinical decision-support tool to identify risks/problems



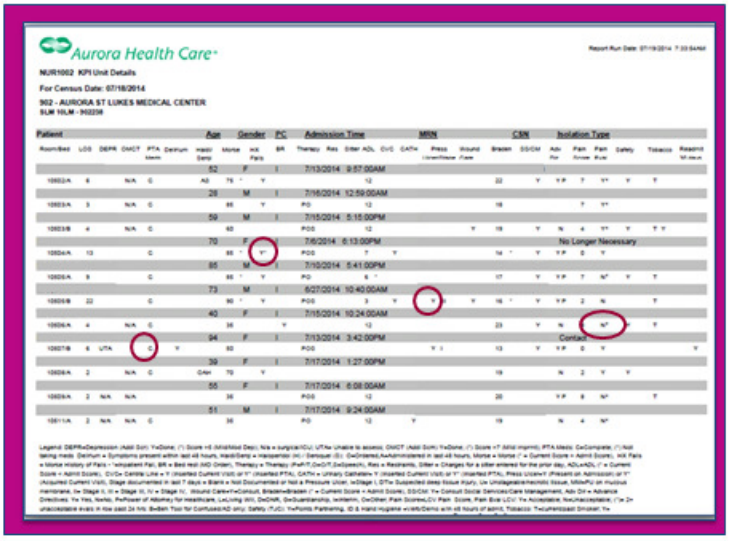
3) **Care Planning and Patient Teaching Functionality**
   - Phenomena-specific care plans provide access to evidence-based goals and interventions that are most appropriate for the patient
   - Care plans have links to flowsheets to support nurses to "associate" documentation of patient status and/or interventions with the plan of care (link assessments with goals)
   - Teaching functionality guides nurses in assessing learning preferences/barriers and in delivering evidence-based topics to help patients know and take action for self-care.

Example: Care Plan and Teaching points for Delirium



4) **Electronic reports to make care visible to support quality improvement and research**
   - Phenomena-specific content can be extracted from the EHR for secondary use for patient care, quality improvement, and research
   - Reports are designed to help leaders to evaluate the end-user's practice and to provide near-real time feedback to address gaps and change practice

Example of a Daily Report:

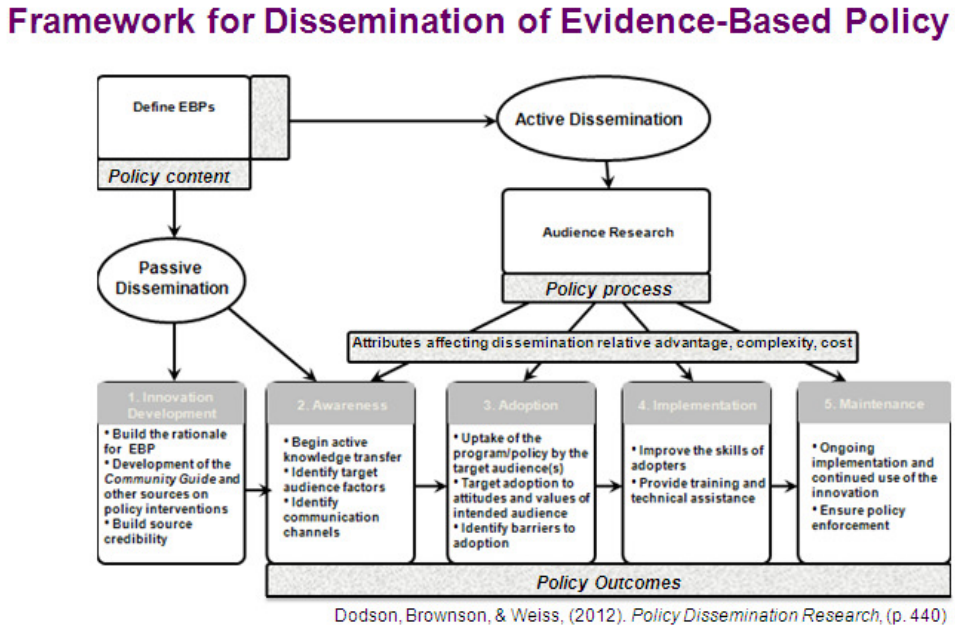


The Key Performance Indicator (KPI) Report is updated daily with data entered by nurses during patient care. The report displays key assessment and intervention data for every patient.

Endusers (leaders) can use the tool to evaluate patient status, identify risks and/or problems and follow up with staff in near-real time to ensure that key interventions are in place.

APPENDIX C. Dissemination & Implementation of Evidence-Based Practice Frameworks

Original Theory:



Dodson, Brownson, & Weiss, (2012). *Policy Dissemination Research*, (p. 440)

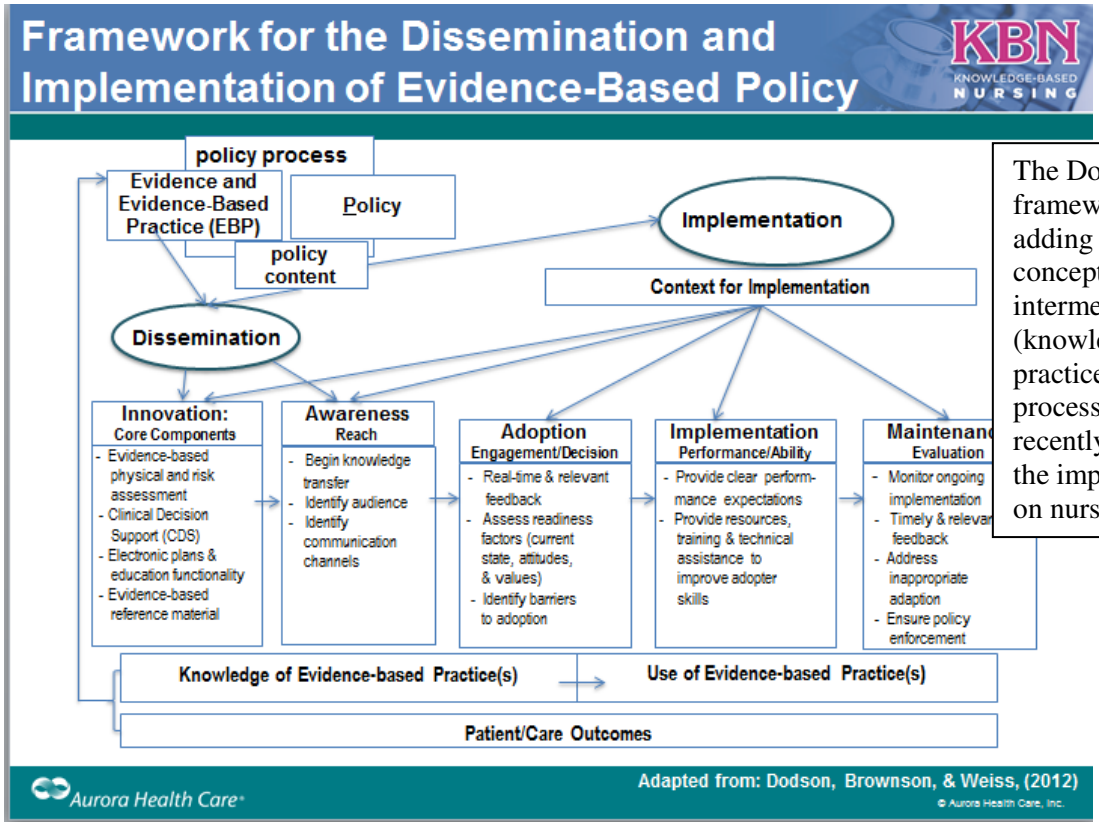
Background: Evidence-based practice (EBP) is a core nursing competency yet barriers limit the use of best practices by front-line nurses. Hospitals use varied strategies to increase the uptake of EBP including policy-, education-, and technology-based interventions, but these strategies are relatively untested. More research is needed about the role implementation processes play in closing the evidence-to-practice gap and how theory-based strategies may assist. Implementation science offers many potentially useful theory-based approaches, but few models are uniquely designed to evaluate the factors influencing EBP uptake by nurses in acute care.

Methodology for Selecting Theory-based Approach: This research team used an established process (Tabak et al., 2012) to identify essential criteria and select and adapt a implementation science framework to support the design and execution of a mixed methods study.

The Dissemination of Evidence-based Policy Framework (Dodson, et al., 2012) was selected as the model with the best fit for the study (see figure above). The framework was adapted to accommodate the aims, population, and setting including concept refinement and the addition of assumptions, definitions, explanatory details, and secondary outcomes to measure knowledge and use of best practices in addition to the identified outcomes.

This theory-based approach was used to guide this study. The adapted framework makes the process for creating and using evidence-based practice policy explicit, highlighting the importance of context, and depicting a range of dissemination and implementation strategy options for achieving outcomes. This model is uniquely operationalized for the hospital setting and may assist in deepening understanding of the factors limiting outcome achievement.

Adapted Framework:



The Dodson, et al., framework was adapted, adding assumptions, refining concepts and details, & two intermediary outcomes (knowledge and use of EB practices). The policy process (upper left) was recently updated to capture the impact of "Big P" policy on nursing care.

Background: Advances in health information technology (HIT) and the use of evidence-based practice (EBP) hold great promise. Little is known about the impact of using decision-support technology to deploy evidence-based policy to guide nursing practice at the bedside. This presentation will present the final results of a study designed to evaluate the impact of embedding EBP recommendations into policy and the electronic health record to support nurses to know and use best practices to achieve outcomes.

Framework: The Framework for Disseminating Evidence-based Policy (Dodson, Brownson, & Weiss, 2012) was adapted and used to guide the study.

Aim: to test if the consistent use of evidence-based nursing practices embedded in nursing policy and the electronic health record (EHR) impacts nursing practice and patient outcomes in acute care associated with six 6 phenomena: pain, falls, pressure ulcers, medication adherence, delirium, and depression/suicide.

Methodology: This pre/post convergent parallel mixed methods study (Creswell & Plano Clark, 2011) was conducted with consenting inpatient nursing units (N = 28 units) from 3 diverse facilities where the EBP policies and technology were used. Measures were developed to evaluate staff nurse and leader knowledge and adherence to EBP policies. Baseline data were collected from multiple sources including non-participant observations with chart audit. Medical/surgical patients were interviewed to evaluate the delivery of key educational messages. Nurses were surveyed to gather demographics, context, research utilization, and knowledge of EBP. Unit-based process and outcome data were also collected.

APPENDIX D. Baseline Unit Descriptions

Facility Decription and Random Assignmnt Plan with Study Group (A or B) Assignemnt after Radomization

Random Assignment	Unit Type	# of Staff (3/2014)	Associated Units # Staff (3/2014)	Total Staff in Group	# Beds	Avg # IP/mo (3/2014)
ASLMC Critical Care Units (5 Units - 370 Staff; 74=Avg Staff /Unit; SD=16.6 Range=48-92)						
B	Neurosurgical ICU (3M/1L)	73	6KLM (37) 10LM (30)	140	16	96
B	Medical/Respiratory ICU (8T)	84	12S (25), 12T (20), 4KLM (34), 4EF (37) 9LM (29)	226	24	114
B	Surgical ICU (3L/3M)	48	3CD (25), 3EF (40), 8C (34),11S (24), 11T (26)	197	14	70
A	Coronary ICU (8S)	73	5KLM (20), 10S (31), 10T (32), 11LM (25)	181	24	118
A	Cardiovascular Surgical ICU (7T)	92	9S (39) 9T (34)	165	30	92
A	Clinical Staffing Service (CSS/Float Pool)	35		35		
ASLMC Medical/Surgical Units 18 Units – 542 Staff – 30 = Avg Staff/Unit; SD=6 Range=20-40						
11 S	Orthopedics/Surgical	24	SICU		24	150
11T	Orthopedics/Surgical	26	SICU		24	154
12 S	Oncology	25	MRICU		24	103
12T	Oncology	20	MRICU		24	94
3CD	Surgical	25	SICU		23	125
3EF	Surgical	40	SICU		26	134
4EF	Medical/Telemetry	37	MRICU		26	143
4KLM/6KLM1	Medical	34	MRICU		32	139
5KLM	Medical	20	CICU		28	130
6KLM/4KLM1	Surgical Neurology	37	NEICU		33	83
8 Center	Med/Surg Transplant	34	SICU		23	131
9LM	Medical/Telemetry	29	MRICU		23	108
10LM	Medical/Neurology	30	NEUICU		28	114
11LM	Medical/Heart Failure	25	CICU		23	104
9S	Cardiac Surgical Step Dn	39	CVICU		24	81
9T	Cardiac Surgical Step Dn	34	CVICU		24	73
10S	Cardiac Procedural	31	CICU		24	91
10T	Cardiac Medical	32	CICU		24	121
Total		**947**				**2,568**

Unit	Unit Type	# of Staff	Associated Units	Total Staff in Group	Beds	Avg # IP/mo
Aurora Lakeland Medical Center (ALMC) - Assignment = B						
Med/Surg 2	Combined Med/Surg	23	N/A	44	34	151
ICU	Critical Care	21			12	70
Aurora Memorial Hospital Burlington (AMHB) - Assignment = B						
Med/Surg West	Combined Med/Surg	29	N/A	46	32	176
ICU	Critical Care	17			10	67
Float Pool		4				
Total		**94**				

APPENDIX E. Methodology and Baseline Findings

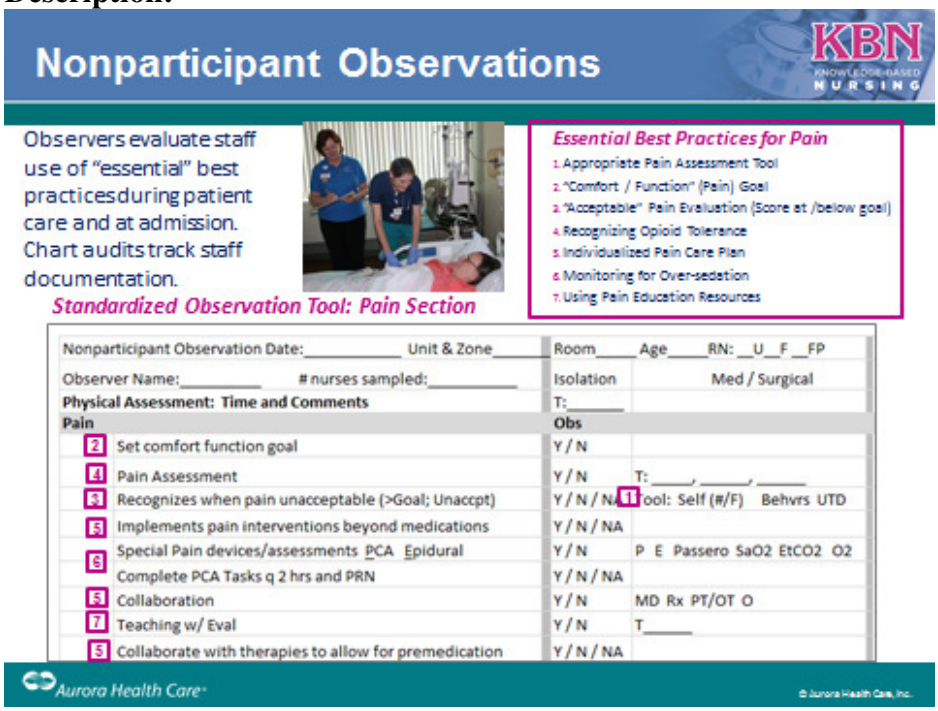
Hypothesis 1: The innovation, deployed with passive dissemination, will have a positive effect on nurse knowledge/use of EBP & achievement of nurse-sensitive patient outcomes at baseline.

Strategy	Baseline – Both Sites	Goal
Nonparticipant Observations & Audits: Staff nurse and leader behavior and documentation	T1: N=429 + 60 Admits	Assess EBP behavior
Nurse Survey: Demographics, Alberta Context Tool (Estabrooks, et al., 2007), research utilization, & knowledge test	T1: N=536 - 51% response	Assess EBP context and knowledge
Patient Survey : Medical/surgical patient demographics & perceptions about nurse interaction, knowledge and use of EBP (10% monthly volume)	Eligible patient volunteers T1: N=211	Assess nurse delivery of EBP to patients
Unit Context and Outcomes: Self-reported, unit data from monthly EBP and other set nurse-sensitive metrics	Compared quarterly results at baseline and 6 months after intervention	Assess characteristics and outcomes

Nonparticipant Observations

Observations were scheduled to avoid student clinical rotation days. Units were advised to conduct care under usual patient care circumstances with no requirement for leader presence. Blinded and trained KBN Team members reviewed the prepared patient list and identified the nurse who had the highest number of selected patients to observe for the 6 hour session. The observers focused on their assigned nurse during patient care and documented their activities on the data collection tool including when they participated in daily unit-based rounds.

Description:



Nonparticipant observers also recorded instances of Nurse Leader interactions phenomenon (e.g. during huddles, rounds, or on the unit with the staff.

Leader Observation

KBN KNOWLEDGE-BASED NURSING

Observers evaluated Nurse Leaders on their use of best practices during patient care or during daily "rounds" or unit "huddles".

Essential Leader Practices: Pain

1. Knows/enforces pain management policy requirements (including safe use of medications with potential side effects)
2. "Supports" staff to accurately assess and document pain care
3. "Supports" staff to initiate a plan of care and intervene if unable to achieve effective pain control

Standardized Observation Tool:

Observations of Nurse Leader Essential EBP Behaviors: Unit _____
Date: Observer:
Huddle: Start Time:_____ Duration:_____ PCM / CNS/NC OFT Information

Behaviors	PCM	CNS/NC
Uses Report to identify patient issues	KPI - H / O / U Pain – H / O / U PU – H / O / U	KPI – H / O / U Pain – H / O / U PU – H / O / U
Demonstrates awareness/knowledge of POC-specific patient assessment that indicates alteration or need for intervention	Del: H / O / U Depr/Su: H / O / U Falls: H / O / U Pain: H / O / U PU: H / O / U	Del: H / O / U Depr/Su: H/O/U Falls: H / O / U Pain: H / O / U PU: H / O / U
Interacts with Staff re: POC (coaching for performance)	Del: H / O / U Depr/Su: H / O / U Falls: H / O / U Pain: H / O / U PU: H / O / U	Del: H / O / U Depr/Su: H / O / U Falls: H / O / U Pain: H / O / U PU: H / O / U
Encourages/Support Staff Nurse to Collaborates with Provider/Team re: POCs	Del: H / O / U Depr/Su: H / O / U Falls: H / O / U Pain: H / O / U PU: H / O / U	Del: H / O / U Depr/Su: H / O / U Falls: H / O / U Pain: H / O / U PU: H / O / U

H= Huddle O=OFT U=Unit

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Example: Findings from Nonparticipant Observations at baseline at the primary site.

Observations by Unit Type at Baseline Primary

KBN KNOWLEDGE-BASED NURSING

Observation Details	Baseline		Population
	N	%	Avg IP/mo
Total Observations	379	100	
Critical Care (5 units)	85	22.4	800
Moderate Acuity (5 units)	69	18.2	800
Blended Acuity (2 units)	37	9.8	280
Combined Med/Surg (6)	102	26.9	1000
Medical (5 units)	86	22.7	760
Day Shift Observations	341	90%	
Average / Ratios	Mean	SD	Range
# Obs Pts / Unit	16.5	2.3	11 - 21
RN : Pt Ratio – ICU	1.9	0.4	1 - 2
RN:Pt Ratio Non-ICU	4.0	0.7	2 - 6

Patient Characteristics	Baseline T1 (N=379)		
	N	%	X – SD Range
Age (yrs)			64.2 ± 16.6 16 – 101
Day of Stay			8.0 ± 12.2 1 – 128
Male	179	47.3	
Surgical	154	40.6	
30 Day Readmit	103	27.2	
Isolation	83	21.9	
Hx Dementia	35	9.2	
Not Taking Meds As Prescribed	11	2.9	

Nurse Leader Observations Baseline

KBN KNOWLEDGE-BASED NURSING

All Units (23 Units; N=49 Observation Days)												
	PCM (N=23)				CNS (n=15)				NC (n=6)			
	Uses Reports	Demonstrates Knowledge	Coaches	Collaborates	Uses Reports	Demonstrates Knowledge	Coaches	Collaborates	Uses Reports	Demonstrates Knowledge	Coaches	Collaborates
Huddles				1								
OFTs	0	2	1	2	8	22	24	9	0	1	1	0
On Unit					2	1	1					
Topics:												
Pain		2	1	3		7	8	2				
Med Adh												
Dep/Suic						1	1					
Falls						5	6	4				
PU						6	4	3				
Delirium						4	6					
Actual Obs	4/49 (8%)				18/39 (46%)				2/10 (20%)			

Note: 93% of Leader Observations occurred during OFTs

Findings: Observation Frequency varied by Unit Type: Critical Care: 44%; Comb Med/Surg: 33%, Blended: 13%, Medical: 5%; Moderate Acuity: 4%
Behavior use varied by Role – CNS were more visible in their support for EBP vs. Managers; Daily Rounds (OFTs) was main event (93%) where Nurse Leaders interacted w/ staff
Round Meetings lasted 41"+ 14" minutes on average – Leaders were present 74% of the time
Conclusion: Leader had limited opportunities for interacting with staff re: EBP at baseline

Nurse Survey: Voluntary on-line survey completed on paid work time; 45 minutes to complete. The Nurse Survey gathered information from nurses and nurse leaders about their personal demographics, perceptions about unit context (Alberta Context Tool), perceptions about Research Utilization, and knowledge of essential practices for six phenomena and workflow.

- Staff: 68% BSN or higher education level (77% at primary site, 59% for community hospitals); 18% were certified (21% at primary site, 12% for community hospitals)
- Leaders: All BSN+ (44% Masters); 49% certified (57% primary site, 33% community)

The Alberta Context Tool (ACT) was used to gather perceptions about unit Context and support for Research Utilization. Selected results from the ACT (e.g. resources & perceptions about staffing) were shared during the training sessions to encourage all nurses to utilize evidence-based policies and CDS and to follow recommended best practices to reduce time requirements for documentation.

RN Survey Participant Characteristics All Sites

Characteristics	Baseline (N=536/1090) – 49%				
	N	%	M	SD	Range
Age (years)	530	99	36.7	12.0	22-66
Registered Nurse Years	529	99	10.2	11.3	0-45
Role / Years in Role	533	99	7.2	8.9	0-43
Staff Nurse Unit	463	99	7.0	8.9	0-43
Staff Nurse Float Pool	20	4	11.45	8.8	0.5-28
Manager	23	4	6.6	8.9	0.5-34
CNS	14	3	11.1	8.6	4-32
NC	6	1	2.5	1.1	0.75-4
Educator/Other	6	1	5.7	8.7	0.5-21
Female	430	90			
Multiple Units					

Unit Context

	Baseline (n=479)	
	N	%
Completed KBN Learning Modules		
Some modules (1-5)	173	36%
All Epic modules (6-8)	194	41%
None or Did not answer (0/missing)	112	23%
Structural & Electronic Resource Use at Work (last typical month) – Never/Rarely/NA		
Policies and procedures (SER 5)	57	12%
Clinical Practice guidelines (SER 6)	72	15%
Clinical decision-support (CDS) SER 8	205	44%
Staffing - Disagree or Strongly Disagree		
Enough Staff for Necessary Work	141	30 %
Enough Staff to Deliver Quality Care	176	38 %

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Baseline Findings: (example)
Nurse Survey participant characteristics were representative of the entire population of nurses at both sites.

Response rate = 49%

Unit context questions revealed that a lower than expected number of staff completed the required Learning Modules associated with EBP education.

A fair number (56 – 12%) reported never or rarely accessing policy and procedures information at work in the last month (12%)

One third reported disagreement with the statement that they had enough staff

Knowledge – Subscale Scores

Subscale Score	N	Average # Correct (Mean)	Std Dev	Min	Max	% Correct	High % Correct
Pain (9Q)	479	4.3*	1.8	0	8	47.3	89
Medication Adherence (4Q)	479	2.6	1.2	0	4	64.0	100
Depression/Suicide (5Q)	479	3.5*	1.4	0	6	69.2	100
Fall Risk (6Q)	479	3.3*	1.5	0	6	55.1	100
Pressure Ulcers (4Q)	479	2.0*	1.2	0	4	49.3	100
Delirium (4Q)	479	1.5	1.1	0	4	38.7	100
Workflow (9Q)	479	5.4*	2.7	0	9	60.4	100
Total Score (41Q)	479	22.7*	8.5	0	38	55.3	93
		*Sign diff LxS No diff by Unit Type					

Key: Total Score includes # Correct, # Not Correct, and # Missing (approx 10%)
High % Correct refers to person who scored the highest in each group

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Nurse Survey Knowledge Test Summary:
At baseline, the average total score was 55.3% correct, scoring lowest in their knowledge of best practices related to pain and delirium. Leaders scored statistically higher on the Knowledge Test than Staff in Total and for all subscales except Medication Adherence and Delirium. There were no significant differences in Knowledge Scores by Unit type.

Additional Context Metrics (e.g. staffing, skill mix, etc.)

Unit Characteristics
All Sites (N=27 Adult Units)

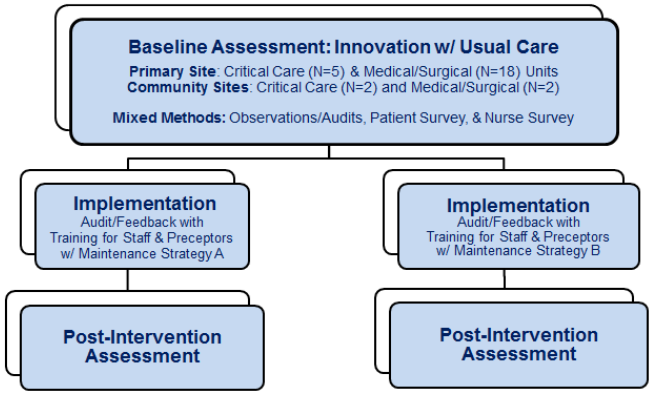
Critical Care (n=7: Primary and Community Sites)	*M*	*SD*	*Percent*	*Range*
Unit Size (# of Beds)	21.6	6.5		14-30
Total Hours per Patient Day	18.37	1.5		17.2 – 20.7
% RN Hours per Patient Day			87%	83 – 90%
Moderate Acuity (n= 5: Primary Site Only)				
Unit Size (# of Beds)	23.8	0.4		23 - 24
Total Hours per Patient Day	10.5	0.6		9.6 – 11.1
% RN Hours per Patient Day			58%	53 – 65%
Medical-Surgical Combined (n=8 Primary and Community Sites)				
Unit Size (# of Beds)	26.2	3.4		23 - 32
Total Hours per Patient Day	9.8	0.7		9.0 - 10.1
% RN Hours per Patient Day			57%	53-63%
Blended Acuity (n=2: Primary Site Only				
Unit Size (# of Beds)	27	1.4		26 -28
Total Hours per Patient Day	10.3	1.1		9.5 -11.1
% RN Hours per Patient Day			62%	57 – 67%
Medical (n=5: Primary Site only)				
Unit Size (# of Beds)	25.2	3.8		23 – 32
Total Hours per Patient Day	9.6	0.4		9.1-10.1
% RN Hours per Patient Day			56%	53 – 62%

Baseline Outcomes –Primary Site

Metric (3 month average)	Baseline (Q2, 2014)			
	N	M	SD	Range
Average Length of Stay^	23	4.68	1.1	3.0 - 6.8
Admissions/Month	23	108.7	26.7	56-160
30 Day Readmission Rate	23	0.17	0.06	0.09-0.31
Press Ganey Pain Management	23	0.83	0.1	0.69 –1.0
Press Ganey Patient Education	23	0.90	0.1	0.72 –1.0
NDNQI Fall Rate (#/1,000 PD)	23	2.04	2.0	0 – 6.5
NDNQI Injury Fall Rate (#/1000 PD)	23	0.60	0.8	0 – 2.6
NDNQI* Pressure Ulcers (#/1000 PD)	23	4.65	6.3	0 – 28
NDNQI* Stage II PU (#/1000 PD)	23	4.29	6.4	0 - 28
KPI: Integumentary Assmnt w/in 4 hrs	23	0.93	0.2	0 – 100
KPI: Braden Assessment w/in 4 hrs	23	0.88	0.2	0 – 0.99
KPI: Morse Risk Assessment w/in 8hrs	23	0.91	0.2	0 – 1.0
KPI: Not Taking Meds Rate	23	0.04	0.1	0.01-0.32
KPI: Delirium Symptoms	23	0.07	0.04	0.02 – 0.16
KPI: Antipsychotic Med Admin#	23	0.04	0.2	0.02 – 0.1

APPENDIX F. Study Intervention with Varied Maintenance Strategies (Group A & B)

Consort Diagram



Baseline Findings: Knowledge Test scores were lower than expected across all topics with gaps in use. Nurse Leaders had limited interaction with staff outside of daily rounds (OFTs).

A **Multimodal Implementation Strategy** was delivered to address gaps:

1) **Audit/Feedback** re: baseline results (knowledge and use deficits) with
2) **Behavioral Expectations** (based on evidence and policy)
3) **Optimization Training** sessions (N=57) were scheduled for 3.5 hours of interactive sessions reviewing Behavioral Expectations.
   Units Implementation: Leaders were provided with their baseline findings and identified priority topics projects to implement and maintain over the next 6 months. Additional funding was provided to engage (2) unit preceptors for each unit to support unit implementation efforts.
4) **Monitoring**: Units were divided into two groups. Usual Care and eMonitoring using reports to identify issues in near-real time and f/u.

Multimodal Implementation Strategy

- Established behavioral objectives based on baseline findings
- Provided general and unit-based feedback
- Confirmed implementation commitment (adoption)
- Provided interactive, scenario-based training (3.5 hours – paid time)
- Supported leaders to identify priority topics and implement

Optimization Training Outcomes (All)

Participation and Evaluation Responses	All (N=1091 Eligible)		Leaders (n=53 Eligible)		Staff RN (Unit and Float Pool) (n=1038 Eligible)	
57 Sessions	N	%	n	%	n	%
Participants	974	89%	53	100%	921	89%
Evaluation Respondents	924	95%	51	96%	873	95%

At the end of this program: I am able to briefly describe what Knowledge-based Nursing (KBN) is and how evidence-based practices are embedded into the electronic health record to support patient care	Leader Respondents		Staff RN Respondents	
	N	%	N	%
Strongly Agree + Agree	48	94%	847	97%

How committed are you to implementing these practices?	Leader Respondents		Staff RN Respondents	
	N	%	N	%
Strongly Agree + Agree	48	94%	833	95%

Knowledge Based Nursing (KBN) Behavioral Expectations

Goal: Promote use of evidence-based, patient-centered practices with accurate, meaningful, and efficient documentation

Navigator / Flowsheets / Care Planning

- Use Navigators to ensure timely completion of all components of the workflow
- Use "Monitoring" flowsheets (e.g. Frequent, PCA/Epidural, Complex, Cardiac, Neuro, Stroke) – ONE STOP SHOP
- Review "Active LDAs" on admission/transfer (edit properties/resolve)
- Manage "Best Practice Advisories" (don't acknowledge if not done)
- Create and maintain PLAN OF CARE (select/remove/edit; Review individualized plan early in shift)
- Know how to see "Care Plan & Patient Education" (LCV on Patient Story or All on Care Plan Overview)
- Ensure care plan outcome documentation accurately reflects progress
- Use "Care Plan" notes to capture issues and interventions when outcomes/interventions NOT MET

Mental Status (Delirium Risk/Actual) / Depressive Symptoms

- Ask questions to evaluate mental status (see ref text)
- Use parameters beyond orientation/memory to describe confusion (LOC, attention, & thought process)
- Effectively identify change from baseline OR fluctuating status
- Use CAM-ICU for ICU patients who are unable to speak (e.g. intubated patients)
- Select and carry out delirium prevention activities
- Report/confirm delirium, aggressively treat cause(s) and manage with non-pharmacological interventions
  Search/treat additional causes when symptoms persist (> 24 hrs)
- Limit use of anti-anxiety and/or sedation medication
- Use depression screening tools to assess and support medical (BPA) and symptomatic (manual) patients

Pain – Comfort/Function

- Select ONE appropriate pain assessment tool (self-report vs. behavior; age-appropriate)
- Partner with patient to set realistic comfort function goal (Typical = 3 or 4)
- Evaluate "acceptable" pain control based on reported pain rating at or below their goal
- Identify symptoms of "opioid tolerance" and deals with heightened pain symptoms at end of drug duration
- Individualize Pain Care Plan: goals based on tool/department, pain interventions (vs. comfort)
- Monitor function with actual observations using tool descriptors: Braden, Morse, ADL Index
- Conduct "Get Up" (Egress) testing when needed: Bed mobility, dangle/stand, walk
- Support early mobilization: upright w/in 24 hrs (if tolerated); Up 2-4x/day (increase frequency/intensity/duration); in hallway 1-2x/day
- Monitor pain management/oversedation using PCA / Epidural /Opioid flowsheet

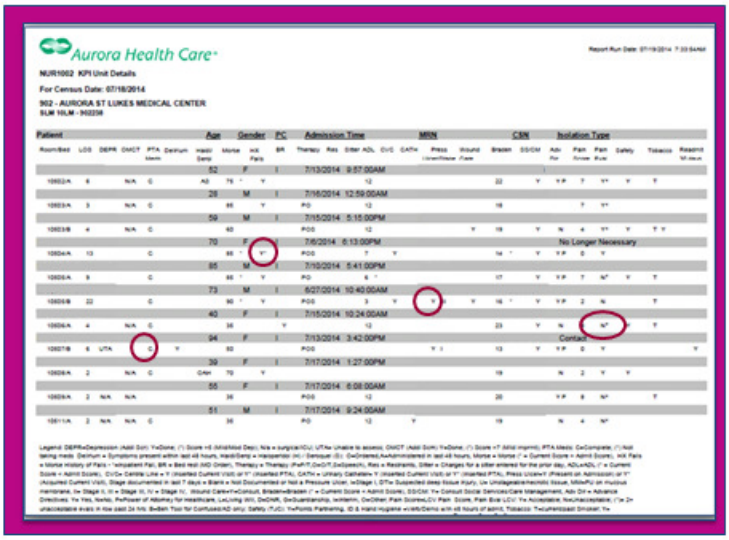
Patient Education

- Identify barriers and preferences for learning during admission (e.g. literacy question, mental status/affect,
- Screen older adults (65+ yrs) for cognitive impairment: Orientation, Memory, Cognition Test (OMCT)
- Identify learning needs - many patients have had with prior stays
- Deliver (and document) individualized education with comments about content or how barriers addressed
- Use visual aids to review important messages about what patients need to DO ("patient engagement")
- Avoid redundancy: If patient verbalized understanding – why repeat?
- Conduct "focused medication assessment" to identify issues (especially if readmission)
- Implement interventions if at risk or actual medication nonadherence issues

Maintenance Monitoring:

- Additional Training (2 hours) was provided to unit leaders and preceptors regarding "Behavioral Expectations", the source of truth (e.g. policy & procedure and/or evidence), additional training materials for the EHR workflows, etc. and 30 minutes to discuss strategies for monitoring staff behavior. Group B received training re: how to access and use the daily KPI report to evaluate practice and to provide near-real time feedback to address gaps and change practice

Example of a Daily KPI Report:



The Key Performance Indicator (KPI) Report is updated daily with data entered by nurses during patient care. The report displays key assessment and intervention data for every patient.

Endusers (leaders) can use the tool to evaluate patient status, identify risks and/or problems and follow up with staff in near-real time to ensure that key interventions are in place.

Details about Preceptor Characteristics and Interventions at Primary Site:

Preceptor Characteristics - Primary

KBN KNOWLEDGE-BASED NURSING

	N	%	M	SD	Range	Median	Training
RN Years Total	48	100	6.4	6.7	0.5 – 34	5.0	
A Surveillance Method (Usual)	18	37.5	7.8	9.0	0.5 - 34	5.0	
B Surveillance Method (eReports)	30	62.5	5.7	5.1	1.0 - 27	5.0	
Preceptor Years Total	48	100	4.4	5.4	0 – 25	3.0	17 (35%)
A Surveillance Method	18	38	4.7	6.4	0 - 24	2.0	6 (33%)
B Surveillance Method	30	62.5	4.2	4.9	0 - 25	3.0	11 (37%)
Study Hours/Preceptor Total	1007	100	21.0	13.0	0 – 47.3	20.9	Avg Hrs / Unit
A Surveillance Method	347.5	34.5	19.3	10.1	6.5 – 38.8	19.0	38.6 ± 19.8
B Surveillance Method	659.5	65.5	22.0	14.5	0 – 47.3	24.1	44.0 ± 24.7
Preceptor Efforts							
Surveillance Tool Skills	30	%	**Logs=Audits (unit)**			N	%
A Surveillance Method	n/a	n/a	A Surveillance Method			8	89
B Surveillance Method	14	50	B Surveillance Method			13	87
Logs=Leader Collaboration	24		**Logs=Education (unit)**			24	
A Surveillance Method	4	44.4	A Surveillance Method			6	67
B Surveillance Method	9	90.0	B Surveillance Method			11	73
Logs=Informal F/up (unit)	24		**Logs=Formal F/u (unit)**				
A Surveillance Method	6	67	A Surveillance Method			1	11
B Surveillance Method	12	80	B Surveillance Method			5	33

APPENDIX G: Post-Intervention Results

Hypothesis 2: Implementation strategies (audit/feedback of baseline results, education with behavioral expectations, leader-driven unit implementation and maintenance) will improve nurse knowledge and use of EBP and produce measurable improvements in outcomes compared to passive dissemination alone.

Strategy	Post – Both Sites	Goal
Nonparticipant Observations & Audits: Staff nurse and leader behavior and documentation	T2: N=422 + 56 Admits	Assess EBP behavior
Nurse Survey: Demographics, Alberta Context Tool (Estabrooks, et al., 2007), research utilization, & knowledge test	T2: N=516 - 47% response	Assess EBP context and knowledge
Patient Survey : Medical/surgical patient demographics & perceptions about nurse interaction, knowledge and use of EBP (10% monthly volume)	Eligible patient volunteers T2: N =213	Assess nurse delivery of EBP to patients
Unit Context and Outcomes: Self-reported, unit data from monthly EBP and other set nurse-sensitive metrics	Compared quarterly results at baseline and 6 months after intervention	Assess characteristics and outcomes

The general patient characteristics were similar between both time periods.

Observations: Patient Characteristics All Sites

KBN KNOWLEDGE-BASED NURSING

Observed Patient Characteristics	*Baseline T1 (N=429)*				*Post-Intervention T2 (N=414)*				*Evaluation Ttest/ChiSq*
	N	*%*	*X - SD*	Range	N	%	X - SD	Range	*p*
Age (yrs)	429		65.0 ± 16.6	16-101	414		65.9 ± 16.2	23–98	0.46
Age – 65+ Yrs	238	55			228	55			0.91
Day of Stay	429		7.5 ± 11.6	1-128	414		8.7 ± 14.4	1–138	0.18^
Male	202	47.2			188	45.4			0.54
Surgical	158	36.8			131	31.6			0.11
30 Day Readmit	113	26.3			91	22.0			0.14
Isolation	93	21.7			96	23.2			0.60
Hx Dementia	43	10.0			41	10.0			0.95
Learning Barriers	84	26.5			95	27.2			0.82
Not Taking Meds As Prescribed	13	3.0			21	5.1			0.13

^Unequal variance, Satterthwaite calculation

Sample findings from Primary Site across the time frame:

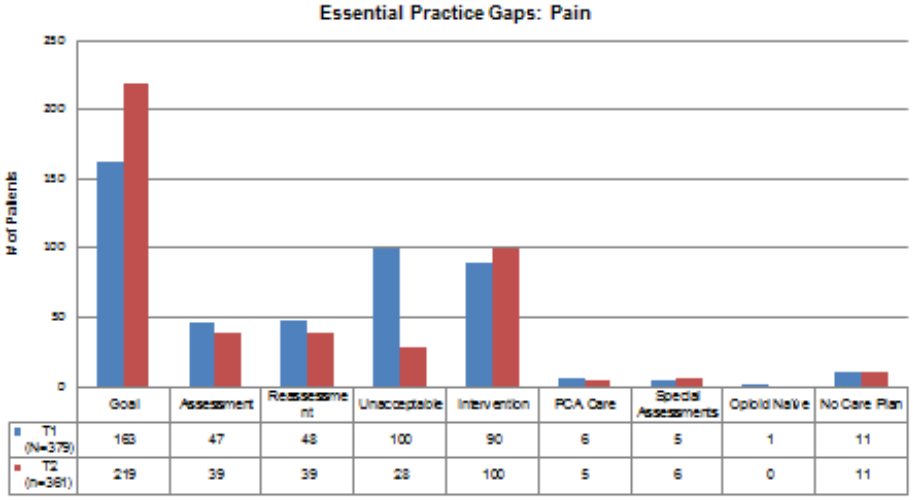
RN Documentation Workflow – All Units

Characteristics	Baseline (N=379)		Post-Intervention (N=361)		Evaluation
	N	%	N	%	
Report Tools					
Computer+Manual+Paper	190	50	113 ↓	31	<.0001
Computer+Manual	43	11	94 ↑	26	
Computer+Paper	35	9	69 ↑	19	
Manual+Paper	60	15	36 ↓	10	
Other	51	14	49	14	
Time to Physical Assessment (shift start)	379	2.0 + 2.1 hr	355	1.7 ± 1.0	0.008
Physical Assessment Documentation*	349		352		
Doc Time w/in 2 hrs of Observed Time	299	78	313	87	0.20
Doc Time 2+ hrs after Observed Time	50	13	39	11	
Entry Time w/in 2 hrs of Observed Time	235	62	206	57	0.03
Entry Time 2+ hrs after Observed Time	120	32	147	41	
Near Bedside Documentation	193	51	258	71.5	<.0001
Learning Assessment (current stay)	202	53	278	77%	<.0001

Convergent mixed methods analysis is based on identifying observed gaps in behaviors for each phenomena and comparing it with associated findings with other data (e.g. Knowledg Test Score, Patient Satisfaction Outcomes, etc.).

Example: Gaps associated with Pain; Each patient observation and audit results are reviewed - if the results indicates that the responses are missing or inconsistent or conflicting findings – the reviewer identifies this as a gap. In the table below, the blue bar indicates "gaps" at baseline compared with red bars for the post-intervention time.

Exploring Gaps: Pain



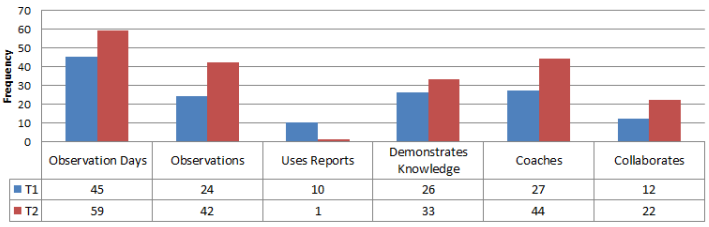
Example of convergence:
The Nurse Survey results showed that the RN Survey Pain Question #2 evaluating knowledge related to establishing a comfort/function goal was also a question that had lower percent correct. These findings provide evidence that need to strength this aspect of care to improve outcomes.

Post Intervention Leader Observations:

- Post-intervention assessments were completed on the Day Shift with additional leader observations. Actual leader observations increased in T2, but it not increase at secondary site.
- Primary site had higher instances of leader observations – but these instances primarily occurred during OFTs (with less actual time spent discussing these topics);
- Reduced report use (despite training) – some reduction in access can be related to the fact that the daily report for the primary site was not posting early in the morning due to heavy data load for the site. This was corrected at the midpoint of the implementation time but it was difficult to get endusers to resume use. NOTE: The lack of report use of reports by leaders in Group B means that all groups were considered usual care (none met the requirement for doing "eMonitoring".)

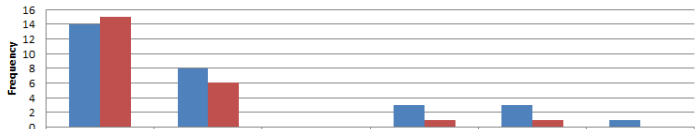
Leader EB Behavior T1 vs. T2

Primary Site (n=23 Units)



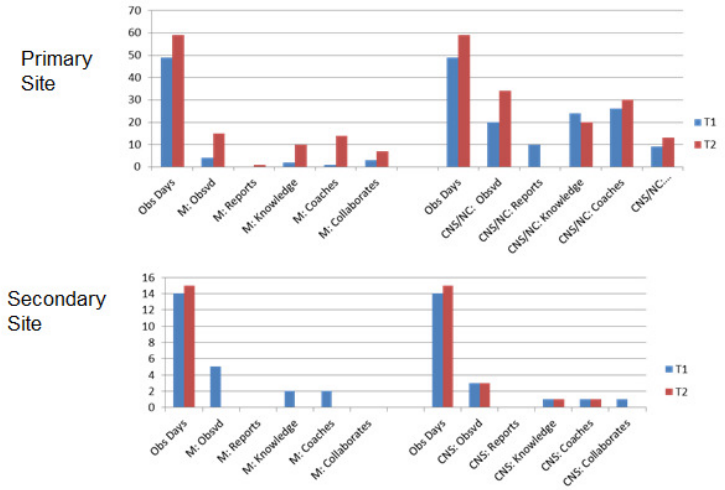
	Observation Days	Observations	Uses Reports	Demonstrates Knowledge	Coaches	Collaborates
T1	45	24	10	26	27	12
T2	59	42	1	33	44	22

Secondary Site (n=4 Units)



	Observation Days	Observations	Uses Reports	Demonstrates Knowledge	Coaches	Collaborates
T1	14	8	0	3	3	1
T2	15	6	0	1	1	0

Leader Observations by Role: T1 vs. T2 Manager vs. CNS/NC - Primary Site



Nurse Survey Participant Characteristics were not statistically different between T1 & T2
NOTE: Only 186 nurses took the survey both times – indepth analysis completed.

RN Survey Participant Characteristics All Sites

Characteristics	Baseline (N=536/1090) – 49%					Post-Intervention (N=523/1102) – 47%				
	N	%	M	SD	Range	N	%	M	SD	Range
Age (years)	530	99	36.7	12.0	22-66	520	99	35.6	11.3	22 - 66
Registered Nurse Years	529	99	10.2	11.3	0-45	514	98	9.1	10.3	0-42
Role / Years in Role	533	99	7.2	8.9	0-43	520	99	6.9	8.5	0-41
Staff Nurse Unit	463	99	7.0	8.9	0-43	465	99	6.8	8.5	0-41
Staff Nurse Float Pool	20	4	11.45	8.8	0.5-28	17	3	10.3	9.4	0.5-33
Manager	23	4	6.6	8.9	0.5-34	17	3	6.4	9.4	0.5-35
CNS	14	3	11.1	8.6	4-32	12	2	9.1	9.1	0.3–33
NC	6	1	2.5	1.1	0.75-4	5	2	3.1	1.5	1.5–4
Educator/Other	6	1	5.7	8.7	0.5-21	3	1	7.0	9.7	0.5–21
Female	430	90				419	90			

The Knowledge Test Scores improved statistically for most subscales – but clinically – the percent correct scores indicated that knowledge gaps remain.

Knowledge Subscale Scores – All Sites

Subscale Score	Baseline (N=536)				Post-Intervention (N=523)				T-test
	M	SD	Range	Correct (%)	M	SD	Range	Correct (%)	p
Pain (9Q)	4.9	2.0	0 – 9	54.2	5.7	2.1	0 – 9	63.1	<.0001
Medication Adherence (4Q)	2.6	1.2	0 – 4	64.0	2.7	1.2	0 – 4	66.3	.24
Depression/Suicide (5Q)	3.4	1.4	0 – 5	69.0	3.6	1.3	0 – 5	71.7	.10
Fall Risk (6Q)	3.3	1.5	0 - 6	55.0	3.5	1.5	0 – 6	59.1	.007
Pressure Ulcers (4Q)	1.9	1.2	0 – 4	48.5	2.1	1.2	0- 4	51.3	.12
Delirium (4Q)	1.5	1.1	0 – 4	38.7	1.7	1.1	0 – 4	43.7	.003
Workflow (9Q)	5.5	2.7	0 – 9	60.9	6.1	2.8	0 – 9	67.3	.0006
Total Score (41Q)	23.2	8.4	0 – 38	56.5	25.3	8.8	0 - 38	61.8	<.0001

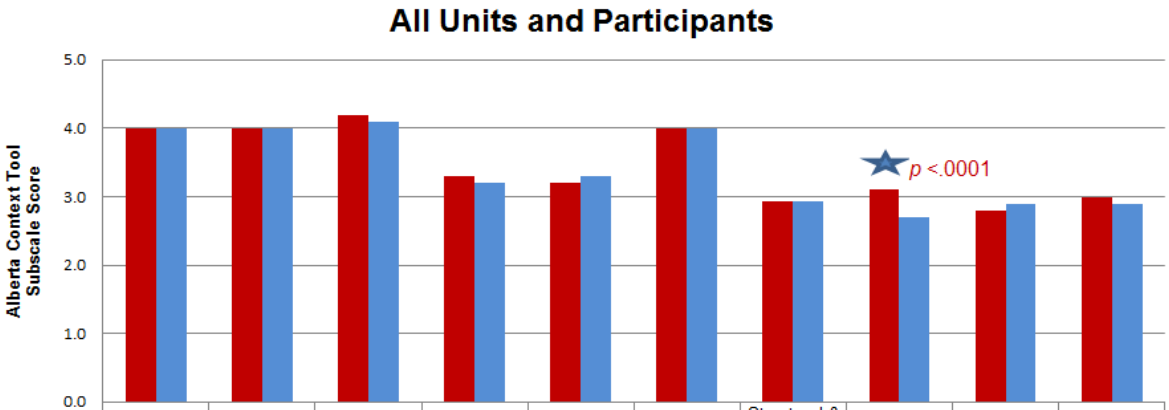
Leader Scores were significantly better than staff at baseline; Difference was not as significant at T2.

Knowledge Scores by Role

Subscale Score		Baseline					T-t	Post-Intervention					T-t
		N	M	SD	Range	% Correct		N	M	SD	Range	% Correct	p
Pain	Leader	37	5.6	1.9	1 - 8	62	.01	29	6.3	2.2	0 - 9	71	.06
	Staff	436	4.8	2.0	0 - 9	53		437	5.6	2.1	0 - 9	62	
Med Adherence	Leader	37	2.8	1.0	0 - 4	70	.61	29	2.9	1.2	0 - 4	73	.15
	Staff	436	2.5	1.2	0 - 4	64		437	2.6	1.3	0 - 4	65	
Depress/Suicide	Leader	37	3.8	1.0	0 - 5	77	.02	29	3.9	1.1	1 – 5	79	.15
	Staff	436	3.4	1.4	0 - 5	69		437	3.5	1.4	0 - 5	71	
Fall Risk	Leader	37	3.9	1.1	0 - 6	64	.002	29	4.1	1.5	0 - 6	69	<.0001
	Staff	436	3.3	1.5	0 - 6	54		437	2.8	1.4	0 - 5	46	
Pressure Ulcers	Leader	37	2.5	1.1	0 - 4	64	.003	29	2.5	1.2	0 - 4	62	.045
	Staff	436	1.9	1.2	0 - 4	48		437	2.0	1.2	0 - 4	51	
Delirium	Leader	37	1.8	0.8	0 - 4	45	.12	29	2.1	1.1	0 - 4	53	.05
	Staff	436	1.5	1.1	0 - 4	38		437	1.7	1.1	0 - 4	42	
Workflow	Leader	37	7.0	2.1	0 - 9	78	.0003	29	5.9	2.3	0 - 9	65	.90
	Staff	436	5.3	2.7	0 - 9	59		437	5.9	2.8	0 - 9	66	
Total Score	Leader	37	27.5	6.2	5 - 38	67	.0001	29	27.8	8.5	1 – 36	68	.03
	Staff	436	22.8	8.6	0 - 37	56		437	24.1	8.8	0 – 37	59	

Context Scores indicate supportive culture for EBP for both time frames.
Leaders and staff reported lower values for Staffing in T2.

Unit Context – T1 vs. T2 All Units



	Leadership	Culture	Evaluation	Formal Interactions	Informal Interaction	Social Capital	Structural & Electronic Resources	OS: Staffing	OS: Space	OS: Time
T1 Mean	4.0	4.0	4.2	3.3	3.2	4.0	2.9	3.1	2.8	3.0
T2 Mean	4.0	4.0	4.1	3.2	3.3	4.0	2.9	2.7	2.9	2.9
T1 N	475	475	471	471	428	468	467	467	466	466
T2 N	464	464	464	464	431	458	458	458	455	456

Patient Education Screening improved. Patient report that education topics reflected content that they were familiar with.

Med/Surg Patient Survey Results

Recalled RN Teaching		N=166 (90%)		N=168 (93%)		7-10% did not recall RN Teaching
APPROACH		Baseline		Post-Intervention		
Method	Explanations during Care	153	92%	154	92%	
	Explanations during Teaching Session	4	2%	10	6%	
	Demonstration	3	2%	0	0%	
Time of Day:	No specific time	48	29%	40	24%	
	Any time doing care	79	48%	110	65%	
Other Things Going on		105	63%	24	14%	
COMMUNICATION						Chi Square
Nurses Explain Things Well		148	89%	160	95%	0.04
Nurses Listen to You During Teaching		153	92%	160	95%	0.16
Nurses Are Kind and Courteous		160	96%	165	98%	0.15
COLLABORATION						
Good/Acceptable Way to Learn - Yes		153	92%	151	90%	0.95
Good/Acceptable Time of Day - Yes		152	92%	150	89%	0.48
Nurses Involved You in Planning Your Care		94	57%	111	66%	0.06

Additional Context/Process Metrics (Sample)

Unit Characteristics
All Sites (N=27 Adult Units)

Critical Care (n=7: Primary and Community Sites)	*M*	*SD*	*Percent*	*Range*
Unit Size (# of Beds)	21.6	6.5		14-30
Total Hours per Patient Day	18.37	1.5		17.2 – 20.7
% RN Hours per Patient Day			87%	83 – 90%
Moderate Acuity (n= 5: Primary Site Only)				
Unit Size (# of Beds)	23.8	0.4		23 - 24
Total Hours per Patient Day	10.5	0.6		9.6 – 11.1
% RN Hours per Patient Day			58%	53 – 65%
Medical-Surgical Combined(n=8 Primary and Community Sites)				
Unit Size (# of Beds)	26.2	3.4		23 - 32
Total Hours per Patient Day	9.8	0.7		9.0 - 10.1
% RN Hours per Patient Day			57%	53-63%
Blended Acuity (n=2: Primary Site Only				
Unit Size (# of Beds)	27	1.4		26 -28
Total Hours per Patient Day	10.3	1.1		9.5 -11.1
% RN Hours per Patient Day			62%	57 – 67%
Medical (n=5: Primary Site only)				
Unit Size (# of Beds)	25.2	3.8		23 – 32
Total Hours per Patient Day	9.6	0.4		9.1-10.1
% RN Hours per Patient Day			56%	53 – 62%

Additional descriptors that describe effectiveness of electronic tools for supporting nurses to implement EBP.

Context: Primary Site

Metric (3 month average)	Baseline (Q2, 2014)				Post-Intervention (Q2, 2015)				Ttest
	N	M	SD	Range	N	M	SD	Range	(p)
Patient Volume									
Admissions/Month	23	108.7	26.7	56-160	23	99.3	22.0	46 – 130	0.20
Average Monthly Inpatient Days	23	615.7	87.3	370-793	23	601.1	106.9	285-736	0.61
Use of EBP based on Documentation (All patients on Unit/Quarter)									
Admission Metrics									
Integumentary Assessment by 4 hrs (%)	23	0.93	0.2	0 – 100	23	0.98	0.01	0.96 – 1.0	0.22
Braden Assessment by 4 hrs (%)	23	0.88	0.2	0 – 0.99	23	0.93	0.04	0.86 – 1.0	0.21
Morse Risk Assessment by 8 hrs (%)	23	0.91	0.2	0 – 1.0	23	0.98	0.02	0.9 – 1.0	0.17
Patients Not Taking Meds (%)	23	0.04	0.1	0.01-0.32	23	0.06	0.1	0.01 – 0.37	0.53
Focused Medication Assessment (%)	23	0.02	0.05	0 – 0.17	23	0.13	0.17	0.0 – 0.60	0.005
Depression Screening	23	0.03	0.05	0 – 0.21	23	0.18	0.14	0.03 – 0.46	0.0001
Patients with Delirium Symptoms (%)	23	0.07	0.04	0.02 – 0.16	23	0.06	0.06	0.01-0.26	0.89
Antipsychotic Medication Admin (%)	23	0.04	0.2	0.02 – 0.1	23	0.06	0.02	0.03 -0.12	0.003

Outcomes – unchanged from baseline . .
NOTE: Some of these outcome are at benchmark level – so change may not be expected.

Nurse Sensitive Outcomes: Primary Site

Metric (3 month average)	Baseline (Q2, 2014)				Post-Intervention (Q2, 2015)				Ttest
	N	M	SD	Range	N	M	SD	Range	(p)
Average Length of Stay^	23	4.78	1.0	3.0 - 6.8	23	4.80	0.92	2.8 – 6.4	NS
30 Day Readmission Rate	23	0.17	0.06	0.09-0.31	23	0.18	0.07	0.06-0.38	0.55
Satisfaction with Pain Management	23	0.83	0.1	0.69 –1.0	23	0.83	0.1	0.64 – 1.0	0.88
Satisfaction with Discharge Education	23	0.90	0.1	0.72 –1.0	23	0.89	0.1	0.77-1.0	0.65
Fall Rate (#/1,000 PD)	23	2.04	2.0	0 – 6.5	23	2.04	1.3	0 – 4.0	0.99
Fall Injury Rate (#/1000 PD)	23	0.60	0.8	0 – 2.6	23	0.42	0.4	0 –1.04	0.34
Pressure Ulcers (#/1000 PD)	23	4.65	6.3	0 – 28	23	2.04	3.0	0 –9.5	0.08
Pressure Ulcers Stage II PU (#/1000 PD)	23	4.29	6.4	0 - 28	23	2.03	3.0	0 –9.5	0.14

Data Sources:
HCAPS
Incident Reports
PU Prevalence Reports

Appendix I. Limitations and Conclusions

Limitations

- Study was time/resource intensive
- Observations required subsequent data entry/cleaning
- Quantitizing was used to transform observations into counts
- Challenges encountered in studying "real" patient care
- Observations reflected actions/conversations (not actual thought processes of nurses or leaders)
- Risk for Hawthorne effect and potential bias associated with use of observational techniques

Conclusions

- The technology performing as designed – cueing staff to the presence of risks and problems for care planning. The care plan technology posed challenges in matching risk to intervention & outcome evaluation
- Baseline findings revealed a supportive culture with gaps under usual deployment conditions (all unit types)
- A multimodal implementation intervention was delivered with audit/feedback and training with tools and funded indirect time to support unit-based implementation and maintenance over 6 months.
- Unit leaders had limited capacity for engaging in implementation and maintenance activities. The intervention was associated with some improvement in knowledge and use of best practices without a change in nursing sensitive outcomes;.

Additional analysis remains in progress with publication.

APPENDIX X **REFERENCES**

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